ALTERNATIVE APPROACHES TO DEVELOPING A CADRE OF "TEACHER TECHNOLOGISTS"

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March 1988

This document was prepared under a contract with the Office of Technology Assessment, Congress of the United States, for the assessment, *Power On: New Tools for Teaching and Learning*. The conclusions are those of the authors. The document does not necessarily reflect the analytical findings of OTA, the Advisory Panel, or the Technology Assessment Board.

J952-38

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ENABLING TEACHERS TO USE TECHNOLOGIES: SEVEN CASE STUDIES
An Overview

ABSTRACT

Nine[1] American case studies were conducted during the summer of 1987. Using a perception-based model, three goals were investigated: a) identification of alternative approaches for teacher training in technology; b) analysis of training purposes and effectiveness; c) development of policy options. The most successful training efforts addressed the goal of developing a "critical mass" of staff usage early in the program and trained teachers to use technology as a tool, fully integrated into the curriculum. Ironically, where the goal was **not** to produce "teacher technologists" but rather to train "excellent teachers who use technologies fully," the number of teachers effectively and enthusiastically using technologies was the greatest. Key elements in successful training efforts included: effective administrative change agents; stable, long-term internal funding; provision of "psychic rewards" to teachers receiving training; direct involvement and support by principals; training in basic applications, not programming languages; an informal support and training network; easy access to technologies both at school and at home; flexible administrative rules and procedures; and a fellow teacher as trainer, one **not** seen as a "technologist."

INTRODUCTION

In the short-run we cannot pin all our hopes on existing preservice education to provide technology-using teachers. Although more students enter post-secondary institutions with some computer experience each year, most colleges of education are several years behind the general university and the K-12 schools in the technology they use. Professors of education are generally not proficient in the use of technology in education, nor are there incentives for them to integrate technology into their courses or to network with content area specialists in liberal arts and sciences. The teacher education reform movement has provided further constraints by cutting back the maximum number of education courses allowed for a teaching degree, thereby making it more difficult to fit technology courses into a teacher's preparation. And when a technology course is required, it does not guarantee that the entry-level teacher has been taught how to use different technologies in the curriculum.

Technology training has occurred, however, through many inservice programs. Some of these programs have been conducted by school systems, some by private entrepreneurs, some through university inservice or advanced degree programs. But little information exists in the literature about the range of programs offered, the different training techniques used, and the impact of the various approaches. There is a need to know what kind of training is most effective in training teachers to effectively use educational technologies. To answer this question, the Office of Technology Assessment, the research arm for the US Congress, contracted for eight case studies dealing with "developing alternative approaches to training a cadre of 'teacher technologists'."

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[1] Only seven case studies are included in this report. The eighth, a study of the Elementary School consortium, is not reported here. The Consortium, as a specific entity, did not conduct training activities in technology. Our interviews yielded seven additional "mini-studies" which we felt should not be included in this report since the individual sites had not been visited by the interview team. The interviews did yield considerable information which is consistent with the general findings of this report. The detailed findings from the interviews conducted with Consortium members will be reported elsewhere. The ninth site visited was Cupertino, CA. This site was not part of the OTA funded study but was visited because of the important contributions made to technology training, and our understanding of the policy issues involved, by the Apple Classroom of Tomorrow project of which Cupertino's Stevens Creek Elementary School is a part. Other ACOT sites visited were Houston and Blue Earth, Minnesota. Interviews were also conducted with Dr. Martin Engel, Director of the ACOT program, his staff, and ACOT teachers from Nashville and Memphis.

THE STUDY

Goals

This study had three goals:

- **identify possible alternative approaches for teacher preparation, training and support in the use of technology;**

- **analyze the different purposes and relative effectiveness of the training alternatives;**

- **develop policy options that might be implemented to strengthen teacher training support in the use of technology.**

The Method

The authors used a perception-based, case study design to investigate developmental sequences of teacher training in technologies. Specifically, this phenomenological model represents a synthesis of the work of Robert Stake, Richard Kunkel, and Lee Schulman. Multiple perceptions of university staff, teacher participants, and trainers during the summer of 1987, were collected using an interdisciplinary team of four evaluators. The study's intent was to identify emergent patterns across a diverse sample of teacher participants and trainers. Toward this end, the following nine major questions were seen as both addressing the study's goals and structuring the interview process:

QUESTIONS	GOALS
1. What training has occurred to date? **2. Who are the participants in the training?** **3. Who are the trainers?** **4. What resources have been allocated for technologies training?** **5. What has changed over time in training?**	**Identify possible alternative approaches to teacher preparation, training, and support**
6. What is the purpose(s) of training? **7. What have been the consequences of technology training thus far?** **8. What facilitated and what hindered training and the use of technologies?**	**Analyze different purposes of training and assess the effectiveness of alternative approaches**
9. What policy issues have been emerging? •equity •certification •training •funding	**Develop policy options**

Significance of the Major Questions

to be able to develop an understanding of the developmental sequence of teacher training in technologies...

We collected multiple perceptions of participants and trainers regarding such issues as how initiatives evolve, what is the role of funding and organizational control on training, who makes the best trainers, what is the role of state mandates and reforms on technology training and implementation, and what is the overall impact of training in technology on instruction.

can common and unique variables be identified across the case studies?

We analyzed the data collected and reviewed some of the literature to see what patterns, if any, emerged across the cases.

to analyze what motivates university faculty and teachers toward technologies...

We interviewed teachers as well as relevant audiences such as trainers and instructional administrators to describe the differential role of support and preparation, teacher holding and repelling patterns, and teacher expectations versus experiences.[2]

to identify generalizations that can be made about the design and implementation of training...

We interviewed university faculty, teachers and trainers and relevant administrators about training purposes, models for facilitating content delivery and thinking, participant selection procedures, scheduling, resources used, and degree of technological integration into the curricula. Indepth interviews provided insights about both successes, program obstacles, and potential replication.

to compile a list of significant policy issues, short-term and long-term, which may facilitate future teacher training...

We addressed four specific policy areas: equity/access; certification; training; and funding. Other issues, such as strategies for initiation, collaboration, evaluation, and the types of technologies anticipated as important for the future were also considered.

Rationale for Selection of the Eight Sites

Eight sites will not present a comprehensive picture of the current status of technology training in the United States. Nevertheless, we wanted, in so far as possible, to select sites with a broad set of characteristics so that we might increase our chances of at least seeing the range of options for training teachers to use technologies now in use.

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[2] Empowerment was a critical issue for teachers and students and requires additional study.

We selected these eight sites for intensive and direct investigation:

- The State of Minnesota
- Albuquerque, New Mexico
- Houston Independent School District
- The Multi-Media Project of Jefferson County, Alabama
- The Headlight (LOGO) Project of Hennigan Elementary School, Boston
- Lesley College
- The IBM/National Computer Training Institute Joint Training Program
- The Elementary School Consortium

We believe the sites selected represent a broad cross section of the various approaches that can be used for technology training. They are: representative of successful and unsuccessful efforts; geographically scattered; funded by local, state, private sector, consortial and grant assisted initiatives; diverse in the ethnic and economic composition of their student populations; state, district, and building initiatives; varied in size, ranging from very small (1500 students) to exceedingly large (190,000 students). We also tried to select sites which had summer activities which could be observed.

Although the sites chosen represent an a wide variety of training programs, they were not necessarily the best or even typical of the training programs offered throughout the United States. They did provide us, however, with significant insights into the training needs in the area of technology and education.

Methodology[3]

Visits to seven sites averaged three to four days each and involved a pair of evaluators to ensure interrater reliability.[4] The eighth case study (NCTI/IBM) included interviews with various participants.[5]

Two major data collection approaches were used: structured interviews and observations of training sessions. Interview schedules were the same at all sites and were structured by the nine major questions of the study. Special efforts were made to meet directors of research and evaluation to gather supportive documentation, as well as interview top-level administrators (e.g., superintendents and associate superintendents) to understand the significance of their involvement over time.

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[3] Table 1, p. 9, summarizes the case study methodology.

[4] Interviews were conducted at five sites, and in Cupertino, by S.A. Tucker and J.H. Strange. In one case (Jefferson County, Alabama) P. Feldman also participated in the interviewing and in one case (the Elementary School Consortium) all interviewing was done by J.H. Strange. A list of those interviewed, by site, is to be found in Appendix I.

[5] Interviews were conducted by G.E. Uhlig. A list of those interviewed is to be found in Appendix I.

TABLE 1. SUMMARY OF CASE STUDY METHODOLOGY

PAGE 1

SITE LOCATION	CASE TYPE	SOURCES OF EVIDENCE
Albuquerque Public Schools	Urban district and higher education partnership	University interviews: Vice President, Dean, 2 education faculty, Director of Continuing Education T-VI interview: Director of Evening Program District interviews: Superintendent; Deputy Supt. for Instruction; Assoc. Supt. - Business; Asst. Supt. - Instruction; Directors of Special Education, Chapter 1, Supply, Occupational Education; Core Subjects Supervisor, Program Evaluation Specialist, Special Assistant for Computer Education, Computer Education Coordinator, CERT team, 12 teachers, 2 principals, 4 Area Superintendents, local AFT president and staff, 2 APS trainers, 8 students Site visits: APS, 2 training sessions, UNM
Apple Classroom of Tomorrow (ACOT) Headquarters (Not a part of OTA Funded Study)	Experimental program in 6 schools nationwide	Interviews: program coordinator and a sampling of central office administrators, principals and teachers from: Cupertino, CA; Memphis, TN; Nashville, TN
Cupertino, California,Unified School District *Stevens Creek Elementary School (Not a part of OTA Funded Study)*	ACOT school	Interviews: ACOT teacher, principal Superintendent, Director of Training, training staff Site visit: ACOT, district technology training session

TABLE 1. SUMMARY OF CASE STUDY METHODOLOGY PAGE 2

SITE LOCATION	CASE TYPE	SOURCES OF EVIDENCE
Elementary School Consortium (Not reported in this document)	National consortium of 30 elementary schools	Interviews: representatives of seven member schools on Executive Committee of Consortium
	Semi-rural district	•Ames, IA, School District (small town-rural)
	Rural district	•Kenai, AK, School District (rural)
	Suburban building	•Hamilton Elementary School, Richardson, TX, (suburban)
	Suburban building	•Lawton Elementary School, Ovidio, FL, (suburban)
	Suburban district	•Littleton, CO, School District (suburban)
	Suburban district	•Gig Harbor, WA, School District (suburban)
	Urban building	•Chinn Elementary School, Kansas City, MO, (urban)
Hennigan Elementary School, Boston City Schools	Higher education & urban building	University interviews: 3 senior MIT staff, 1 external consultant directing training program, 6 MIT graduate assistants
		Building interviews: 10 Hennigan teachers, assistant principal, principal, 3 students, 1 parent
		Site visits (2): summer training, follow-up visit to Hennigan School during school session
Houston Independent School District	Urban district	District interviews: Deputy Supt., Asst. Supt. for Curriculum, Executive Director of DOT, 11 DOT managers, 5 DOT staff, 3 principals, 6 teacher technologists, 2 regular teachers, 2 special education teachers, Director of Research & Evaluation
		Site visits: DOT, Black Middle School (ACOT), 2 DOT training sessions
IBM - National Computer Training Institute	Business initiative	NCTI interviews: President of NCTI, 2 IBM administrators, 1 trainer, 5 trainees

TABLE 1. SUMMARY OF CASE STUDY METHODOLOGY

SITE LOCATION	CASE TYPE	SOURCES OF EVIDENCE
Jefferson County, Alabama School District	Suburban district	District interviews: 1 board member, Superintendent, multi-media program coordinator, Director of Staff Development, Director of Public Relations, 17 teachers (individually), 3 principals, 2 students, group interviews with 67 administrators and teachers from all 13 schools in the program Private sector interviews: owner of local computer store, 2 administrators from Alabama Power Company Site visits: Hewitt Elementary, Hewitt Middle, Cahaba Heights Community School, Alabama Power Company, Jefferson County School Board meeting Follow-up interviews: Fred D'Ignazio; 2 teachers; Directors of Staff Development, Public Relations; Director of Curriculum, Royal Oak, MI, Schools
Lesley College	Higher education	College interviews: Computers in Education Program Director; Undergraduate and Graduate Education Directors; 4 campus-based teacher trainers; 5 on-campus teachers; Director of Outreach Program; Professional Outreach Associates Director and 2 staff; 2 Outreach teacher trainers; 17 Outreach students

TABLE 1. SUMMARY OF CASE STUDY METHODOLOGY PAGE 4

SITE LOCATION	CASE TYPE	SOURCES OF EVIDENCE
Minnesota	State	State Department of Education interviews: Manager and staff of Curriculum and Technology Section Consortia interviews: 3 MECC staff and 2 TIES staff Higher education interviews: University of Minnesota College of Education Dean, Associate and Assistant deans; 1 faculty trainer District interviews:
	Urban district	• Minneapolis Public Schools: Technology Coordinator; Media Services Director; 2 tech resource teachers;
	Rural district	• Blue Earth Public Schools: elementary principal; director of ACOT Project; secondary principal; district computer coordinator; 3 teacher trainers; Project Beacon coordinator; 8 teachers in training;
	Rural district	• Shakopee Public Schools: technology coordinator;
	Urban district	• St. Louis Park Public Schools: instructional computing trainer,
		Site visits: Minneapolis Public Schools' Media Services; Blue Earth Public Schools' Elementary School; Blue Earth summer teacher training workshop; Shakopee Public Schools' Junior High; TIES; MECC; University of Minnesota College of Education; UM computer center; Minnesota State Dept. of Education

FINDINGS[6]

Purposes of Training

Training emerged as most important where technologies were clearly seen as a **tool which could be integrated into the curriculum.** The most successful training efforts addressed the goal of developing a "critical mass" of staff usage early in the program and trained teachers to use technology as a tool, fully integrated into the curriculum. Ironically, where the goal was **not** to produce "teacher technologists" but rather to train "excellent teachers who use technologies fully," the number of teachers effectively and enthusiastically using technologies was the greatest.[7]

Importance of Key Change Agents for Development of Cadre

One of the key findings of this case study is the necessary presence of change facilitators, a catalyst or catalysts, who can mobilize interest in technologies beyond hardware and software issues to an action level so that training is systematically designed and budgeted. Change agent styles were varied and ranged from "low-keyed" administrators to charismatic individuals. In one case there were three change agents working closely together.[8] In the absence of a key change facilitator, it appeared technology training issues failed to surface and capture the attention of decision makers.

Necessary Resources and Incentives

Successful change agents did not operate in isolation. Training seemed to require a holistic effort. One key actor across all successful sites was the presence of a private vendor, particularly Apple Computers, Inc. and IBM.

Other key actors included local and state politicians, economic development groups, and State Departments of Education. The consistency and long-term nature of this support cannot be overemphasized. The analogy of the tortoise and the hare comes to mind when looking at the steady efforts of Minnesota marshaling its scarce resources versus rapid efforts in Texas which could not be sustained when the oil industry declined.

The role of parents as key players was not consistently displayed across sites.

The eight case studies revealed **a wide range of monetary resources.** Successful training endeavors had direct costs of as little as $5 per teacher to over $1000 per trainee. All sites contributed great amounts of time to training activities without charging that time to training. Consequently, real cost figures for training are virtually impossible to determine.

Effective staff development efforts looked at the funding issue beyond short-term hardware and software purchases and "quick-fix" training for an elite core. Consistent across all sites, ready access to equipment was one of the most frequent issues that impacted the long-term success of training and transfer value to the field. When the majority of hardware and software resources were gifts, the question of permanent, internal support was only postponed.

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[6] The major findings from each case study are summarized in Table 2, p. 16.

[7] Albuquerque, Jefferson County, Minnesota, Lesley College

[8] Ames, Iowa, part of the Elementary School Consortium reported elsewhere.

The present research suggests that money alone is not a sufficient factor for predicting success in training a "cadre of technologically literate teachers." **Psychic rewards were seen to be critical**. The enthusiasm and excitement in Jefferson County, Alabama; the great pride in Blue Earth and other Minnesota communities; the enjoyment of associating with the famous and having important visitors at Hennigan School; national recognition that comes from being the center of attention and highly visible as in Houston; the community support that passed a five million dollars bond levy earmarked just for technology as in Albuquerque--all played an essential role in explaining why people can be trained in the absence of individual cash incentives.

Finally, another essential factor was **building level support**, particularly direct involvement by principals. The significance of superintendents seemed to be less critical, particularly during the onset of training.

The Trainers and Their Styles

One conclusion stands out: **the most effective teachers were those who are seen as teachers, not technologists** or members of the "technology priesthood." Usually these teachers were reported to have recent classroom experience, to successfully use technologies in *their* teaching; to know how to integrate technologies into their subject areas. They were also: enthusiastic and able to work with adults in groups and individually; sensitive to the fears of non-users; and **not** insistent on training teachers to be programmers. The majority of trainees also commented that the most effective trainers encouraged hands-on, practical, and a mix of interdependent and independent learning. Interviews with trainers consistently reported their formal training and degrees appeared to be irrelevant to their success.

Where aides or specialists handled training and teaching, the long-term instructional effects on regular teachers tended to be more transitory. The most effective training seemed to occur when there was an organized and formal training program followed by continuous informal training at the building level and easy access to technology hardware and software. When this **three-step sequence** was the case, teachers did not seem to harbor resistance to the initial training even if it were "mandated."

Size of Districts

The size of districts seemed to have an impact on the type of training that emerged. The size of the training task led large districts to train their own staff. Small and medium-sized districts turned to external training programs such as Lesley College or state or regional service centers like MECC and TIES in Minnesota.

Factors Encouraging Training

The list is simple, not unique to training in the area of technology, and really not surprising:

- Support from a principal;
- Availability of, and easy access to, computers and other technologies;
- Supportive, practical training from a permanent, broadly representative support team or teams that include central decision-makers, as well as teachers;
- Mechanisms for easy availability of coaches and which encourages teamwork and networking (formal and informal);
- A clear view of how teachers can use technology to teach specific subject matter (or to

integrate specialities into a broader view of the curriculum);
- Flexibility, risk-taking, experimenting with opportunities in the classroom;
- A principal who will be a buffer to opposition from resistive building staff and administrators.

Ultimately, the Superintendent and Board must be informed and supportive, and must make their support known to teachers.

The central finding is this: getting teachers fully involved in using technologies does not require them to become technicians, or specialists in technologies. Training is much more effective when the objective is to train teachers to use the technologies as tools in their teaching. They need to know how to use equipment and software. But these objectives are not *ends*. They are steps in a much more important process: the use of this knowledge, these skills, in improved teaching of the curriculum. No single teacher needs to "know it all," to be a "technologist." Teamwork and sharing make the use of diverse technologies possible.

Factors Inhibiting Training

Surprisingly, time, or the lack of it, was not a negative factor. In fact we were told over and over that we should talk to the busiest teachers; "they are the ones who have time for growth." Rather the strongest impediments were reported to be:

- A technical (or programming) approach to technology;
- Opposition from the principal and system at large, particularly in terms of mastery-based instruction which prohibits alternative methods of meeting common ends;
- Limited access to hardware and software at school and home;
- Equity issues within systems;
- ~~The absence of~~ any rewards, either psychic or monetary;
- Emphasis on theory as opposed to practical skills;
- Trainers who were seen as technical specialists without experience in using technologies in *their own* classrooms.

TABLE 2: SUMMARY OF KEY FINDINGS BY SITE

SITE	KEY FINDINGS
Albuquerque	Bond issue for computers a major stimulus Extensive, effective involvement with Higher Education Active, supportive central office; effective centralized planning fully integrated with higher ed (4 year and community college) as well as district Technology planning is staff (as opposed to a line) function Training (64 hour sequence) focused on applications and integration throughout curriculum Curriculum major focus, and how technology can be used to teach Primary emphasis on computers Trainers drawn from teaching staff: CERT team and building level key teachers. ABQ staff teach college credit courses Extensive community involvement driven by high tech community Staff involvement through CEMT Over 75% of teachers now trained; new hires required to be trained or receive training
Houston	Separate, centralized, line organization recognized nationally Currently being decentralized as a result of changes in superintendency Very large district: 11,000 teachers; 190,000 students (80% minority) Emphasized comprehensive, extensive (296 hour) competency based training program for Teacher Technologists (goal: one per school) Parent access well developed and effective Heavy reliance on federal (Chapter 1) funds; significant decreases in local funding since inception of program (oil recession) Comprehensive program - wide variety of technologies, developed own software, extensive evaluation of externally developed software Trainers drawn from teaching staff Trainers provided continuing (to date at least) monetary incentives Extensive plans to thoroughly integrate technologies throughout curriculum; implementation not far along Training program negatively impacted by state regulations and requirements
Jefferson County, Alabama	Multi-media: video; synthesizers; communications in general; computers Curriculum central focus; technology merely a tool Project, grew from 20 to 113 teachers in one year All voluntary; incentives primarily psychic Trainer external to educational, business communities Teachers trained selves by doing; very informal Teacher cadres, or teams, played central role in training process Strong participation and support from building principals Superintendent not uninvolved Project highly spontaneous; planning begun after project underway Funding limited ($ 5,000) plus corporate contributions; funding totally scrounged from other sources - not allocated to project through some deliberate budgetary process Project a central focus for public relations at building and district level Very successful project with small expenditure of funds

TABLE 2: SUMMARY OF KEY FINDINGS BY SITE, page 2

SITE	KEY FINDINGS
Hennigan School	Project driven Project heavily influenced by University based personalities (Papert and his graduate student followers) International visibility Funding totally external to school system (IBM, NSF) Project very small - 15 teachers Project exclusively focused on LOGO and LEGOLOGO Project not integrated into school or system; no plans to integrate since project seen as "research" which will provide answers to whether or not integration should occur Purpose of training reported to be the development of a "culture", in which computers are tools, rather than the development of technical expertise Project unable to specify modes for determining when "culture" had been attained Project remains special and elite
Lesley College	Trained over 7,000 educators Systematic, comprehensive, thoroughly planned degree driven training Trainers drawn from teachers in schools, not University based faculty Funding entirely generated through tuitions (some of which are provided by districts; some not) Focus on practical uses of technology; theory avoided Able to modify program quickly; tailor program to special needs of districts when requested Program reflects significant institutional risk-taking in program development and implementation, especially in front-end investment of planning, hardware and delivery funds Three phases of trainees: early enthusiasts; those seeking specialized career (computer specialist, etc.) credentials; general teaching population drawn through district based incentives drawn to degree attainment Little success in recruiting administrator, or those for whom degrees relatively unimportant, in significant numbers Has impacted certain districts significantly (Colorado Springs, others) 80 % of training delivered in the field Program negatively impacted by restrictive policies of certain states limiting access of out-of-state educational institutions

TABLE 2: SUMMARY OF KEY FINDINGS BY SITE, page 3

SITE	KEY FINDINGS
Minnesota	Comprehensive, state-wide, long term (15 years) program; has enabled the purpose of training to transcend, on a state wide basis, mere literacy issue Regional training Demonstration sites stimulated significant local program development and training State encourages the development of multiple models; no state determined "answers" to use of technology, its implementation, and training in its use; decentralized approaches encouraged through state policy State encourages focus on curricular issues, not on technology per se Continuous, long term focus on technology that reflects state emphasis on technology Significant state support in terms of funding, ideology of importance of technology, need for local participation in planning, implementation and program maintenance Focus on integrating technology throughout curriculum Extensive development of consortia for program planning, development, implementation, training, software development Have become source of most non-profit developed software available to primary and secondary schools in the U.S,. (MECC) Networking plays a a central role in program development and implementation Long-range planning extensive and encouraged at local and state levels Role of higher education has been relatively unimportant in training but has been important in research which has led to identification of key issues Extensive partnerships among business and industry, regional centers, quasi-governmental organizations
NCTI/IBM	Trainer of Trainer Model Vendor funded, managed, planned, and driven Extensively planned program, but unable to modify implementation to fit technological and organizational changes High emphasis on networking which continues despite demise of formal training project Training designed to be specific to single vendor for marketing purposes Trainers came from technological specialists, many of whom were not class room based teachers Hardware issues dominated planning and implementation; software issues were not addressed in timely fashion; curriculum issues never surfaced as an issue Project considered a failure Designated trainees representative of broad cross section of primary, secondary and post-secondary education

POLICY RECOMMENDATIONS

The Primary Recommendation

Our study leads us to one very important conclusion before we can address the full range of policy implications. This study began by focusing on the alternative approaches that are available to create a cadre of "teacher technologists." The authors of this study now believe that is the wrong focus, the wrong objective. Rather we suggest that the question should be **how do we create a cadre of teachers who are able and willing to maximize the use of technologies as powerful tools to improve and reshape their teaching?** We conclude that federal, state, and local policies should **not** be directed to the training of a select group of teacher technologists. ***We believe training in the use of technologies as tools must be provided to all teachers.***

Why have we made this shift? It is clear that those teachers who are trying to integrate technologies into the curriculum, those teachers who are using technologies to help students see and learn in an integrated curriculum, are the most excited with their successes, describe the most profound changes in their students and themselves, and look at their role as teachers in a new light. This finding was not anticipated. The way in which an integrated approach has affected teachers and training was not a focus of this study; but we found it, can document it, and will make it the focus for future studies.

Given this change in focus, a number of policy recommendations emerged.

Equity

Policies must address equity issues. There are two facets to this issue. First is the great discrepancy between the availability of technologies to schools and technologies used in the training programs of private industry. Schools must rapidly acquire increased levels of access to technologies in order to facilitate the training of future workers. This will require a major expenditure of funds. Secondly, there is an extremely wide variation of the availability of technologies within our schools today. Some schools have a computer for every five students. Others have a computer for every 150 students. The results of such discrepancies, if not addressed, will be serious indeed for those students unfortunate enough to live in a district which has not equipped its students and staff for the twenty-first century.

Make diverse technologies as widely available to teachers and students as rapidly as possible; that is, provide lots of equipment, software and other tangible support. Apple's Classroom of Tomorrow Project proposes one computer for every learner. (Both teachers and students are seen as learners in this paradigm.) That seems a reasonable goal. Our culture easily supports a car for all adults, even two in many cases. Why not set a similar goal for teachers and students? No school has enough technologies available at present, whether we are talking about telephones, copy machines, computers, or video cameras. At this time, the amount of hardware and software is not as important as a real commitment to remedy an inadequate availability of technologies to teachers and students. And teachers should have a choice in which they want first if they can not have everything at once.

Certification

Adopt fewer rules and regulations. In every case studied, top-heavy rules, whether they were state or local, inhibited the integrated use of technologies. Some rules were established for what their proponents obviously thought were "good" reasons. If rules do exist, they must be flexible. The mandates and reforms of Texas had an especially negative impact on the Houston program.

Training

A district should, concurrently, implement training activities that:

- Are overtly supported by principals;
- Provide readily available resources - in the classroom if at all possible;
- Are supplemented by supportive, practical training from fellow teachers;
- Combine the use of a coach and a network of other users for continued growth;
- Are conducted in an atmosphere of excitement and challenge;
- Provide teachers with a clear view of how they can use technologies to teach specific subject matter (or to integrate their specialities into a broader view of the curriculum;
- Lead to experimentation, flexibility, and risk-taking on the part of the teacher - *in his or her classroom.*

Trainers should be those seen as teachers, not technologists. The symbolism is important, but it is more than that. Trainers should be people who:

- Have a commitment to the use of technologies as tools throughout the curriculum;
- Have practical experience in using technologies in *their* teaching;
- Are effective teachers of adults;
- Are team players, who can establish themselves as partners with the the teachers who are students in the learning process;
- Are supportive, who emphasize the inter-dependence of teachers in using technologies, and who emphasize the personal impacts rather than technical mastery.

Funding and Support

- **There must be a commitment of internally generated and controlled resources, especially money.** Extensive reliance on external funding - whether federal, state or private sources (business, PTOs, etc.), leaves districts vulnerable or restricts the long-term viability of the approaches they can take to use technology throughout the curriculum.

- There must be (or there must evolve) a permanent, broadly representative support team or teams that include central decision-makers, as well as teachers. Ultimately, the Superintendent and Board must be informed and supportive, and must make their support known to teachers.

- There must be mechanisms which encourage teamwork and net-working activities.

- There must be an environment in which teachers truly believe they are *empowered* to use technologies as tools in their teaching, even though this may conflict with current rules or ways of doing things.

- There must be "space" for the change facilitators, trainers and teachers to be creative, to generate interest in and excitement about the use of technologies as educational tools.

Other

Multi-media approaches offer effective methods for rapidly training teachers to use technologies across the curriculum. The results achieved in Jefferson County, Alabama were most impressive. The multi-media approach should be carefully considered as an effective route for introducing new technologies into schools.

Do not delegate use of computers to aides, or specialists. The central recommendation that we have made should preclude the necessity for this policy recommendation. But our observations about how "letting someone else do it" creates a difficult environment for training all (or any significant number) of the teachers were so vivid that we felt this point must be emphasized.

Address the retraining needs of current education school faculty. This study focused on the technology training issues surrounding the K-12 teacher. Our study indicates that the need for technology training for teachers is even greater at the post-secondary level. Ways will have to be found on national and state levels to do the types of things Lesley College' Computers in Education Program and the University of New Mexico's College of Education have done: create opportunities for the teachers who are using technologies as tools in *their* teaching to become the teachers of other teachers, including the current faculties at institutions of higher education.

CONCLUSION

In one sense the development of policy recommendations, which was the original purpose for this study, has not been the most important outcome of the study. The most important conclusion is that effective training for technologies requires the training of *all* teachers, and also requires the ready availability of equipment if the training is to have any utility. An assumption behind the original study design was that it might be possible to train only some teachers, a cadre of "teacher technologists." Some teachers will, of course, become more adept and experienced in the use of technologies. But the clear conclusion of this study is that efforts to get technology used throughout the K-12 curriculum necessitates the training of all teachers. A "cadre of teacher technologists" will not be particularly helpful in attaining that goal.

In another sense an important policy consideration does emerge from this study. Training and the availability of equipment go hand-in-hand. This country has the ability to equip all of its teachers and students with powerful new tools that will enhance their abilities as teachers and learners. The positive impacts resulting from the use of these powerful new tools are quite clear from this study. What is needed now is a policy to provide those tools to all teachers and learners within a reasonable period of time.

HENNIGAN SCHOOL HEADLIGHT PROJECT
Using LOGO Throughout the Curriculum

INTRODUCTION

The Headlight Project at the Hennigan School in Boston, Massachusetts is entering its third year in the fall of 1987. We chose the Hennigan School as a case study because it was a building level project and because of its high visibility as the locus for Seymour Papert's work with LOGO. As developer of LOGO, and author of Mindstorms: Children, Computers and Powerful Ideas, Professor Papert is an internationally recognized and acclaimed authority on computing and education. Currently, he is the Director of the Media Laboratory at the Massachusetts Institute of Technology. Also participating in the project are three senior staff members and approximately 15 graduate students from MIT who conduct research on various aspects of the project.

The Hennigan Elementary School (K-6) is located in the Mission Hill neighborhood of Boston. The majority of the residents in the Mission Hill area are lower and working class. The school's 650 students, roughly an equal distribution of Black, Hispanic and Anglo, reflect the ethnic composition of the community where the school is located. Approximately 220 students (35%) are participating in the Headlight Project. Although the Hennigan School is now one of the best known schools in Boston, it has not always been that way.

The project was located in Hennigan after all the schools in the district were invited to submit proposals of interest and commitment. Two Hennigan teachers teamed together to write their application (and these two teachers continue to be especially supportive participants in the project). MIT staff indicated that Hennigan was selected for several reasons, including its open "pod" structure which facilitates sharing, and the ethnic composition of its student population.

The project centers around four networked clusters of donated IBM-PC Jrs, each with 14 micros. In addition, there are about two dozen more PC Jrs scattered along the pod walls and in the classrooms themselves. Currently, the project ratio of computers-to-students is about 1:3 versus 20 personal computers for 430 non-project students at Hennigan School. LOGOWriter is the software of choice, but other LOGO programs are available. Fifteen of the fifty Hennigan teachers participate in the LOGO project and represent all grades.

Teachers bring their classes to the clusters for varying amounts of time during the week. Some classes come every day, some less frequently. MIT graduate students assist teachers, and in the case of LEGOLOGO especially, the MIT graduate students teach many of the classes while demonstrating new and advanced approaches to the use of LOGO and LEGOLOGO.

Project resources have been plentiful. Federal dollars have played a significant role in funding the project, including initial seed monies from the United States Department of Education's Project Lighthouse and currently from the National Science Foundation. IBM made a significant cash contribution to the project in its first year. Ongoing hardware and software donations have been received from IBM and LEGO. Limited local funds were allocated for the first year in the form of liaison staff from the school district's central administration computer department. No other local funds have been used in the project. By comparison with other projects reviewed for this study, only the Apple Classrooms of Tomorrow (ACOT) exceed the per-participant external contributions made to a project.

KEY ACTORS AND EVENTS

15 Teacher Volunteers

The 15 Hennigan teachers are central to the project. Many of these teachers asked to be a part of the project because they had a personal desire to expand their knowledge of, and ability to use, computers. Many report that this interest was stimulated by a desire to develop new job opportunities, or to develop skills and abilities that might lead to a better protection of their jobs in the district. Several of the teachers had taken introductory computer courses before beginning the LOGO project. Some of these classes were offered by the local school system, but a significant number were Lesley College courses.

Most of the teachers interviewed expressed a great deal of pride in being associated with the project and reported that they felt positively rewarded by the high national and international visibility of the program. Some, however, expressed disappointment that LOGO did not seem to be a career enhancing skill or knowledge base. One teacher explicitly said she was looking for a way out of teaching. She desires a position where she will be rewarded more generously, especially with the computer skills which she has developed.

There has been only one addition to the 15 member team since its inception. In 1986, one teacher replaced another teacher who left Hennigan to attend graduate school.

School District Administration

The School Board and central administration of the City of Boston have been only peripherally involved in the project. Local administrative support has come from the principal of Hennigan at the time of the inception of the project (now reassigned to central administrative duties) and Assistant Principal, Bob Holland. The current principal's involvement seems less direct, and takes the form of regular meetings with Dr. Papert and workshop participation. The Assistant Principal visits the computer pods every day, participates in project workshops, and attends project meetings after school.

The MIT Connection

University involvement is central to the Hennigan LOGO project, but the nature of this involvement differs from the typical College of Education. Coordination, training and support is provided by The Media Lab of The Massachusetts Institute of Technology. Staff participation is on three levels. Administrative and program support is provided by Dr. Papert and three other senior researchers: Sylvia Weir; Edith Ackermann; and Stephen Ocko; Consultation, technical assistance and informal training is conducted by Harry Nelson, a MIT graduate who visits the program twice weekly and who coordinated the summer training efforts in 1987. A revolving number of MIT graduate assistants (about 15 each semester) observe, interview, and test elementary students; participate in the teaching of students using LOGO and LEGOLOGO; videotape activities associated with the project (as a part of a dissertation in the area of video and media); and assist in the summer training.

TRAINING

Formal Training

Formal training has been conducted for project teachers in the summers of 1985, 1986 and 1987. In the first two years, summer training consisted of a mandatory two weeks of all day training followed by one week of optional participation in the annual LOGO Conference. Sponsored by and held at MIT, this conference drew educators from around the world. At the beginning of year three, the training design was changed to require attendance at one week of summer training held at Hennigan School followed by an optional week of training at MIT.

In 1987, the LOGO Conference was not convened during the summer. MIT staff reported the conference is being redesigned and appears to be moving toward a smaller, more focused format. Projected to be held in early 1988, several Hennigan teachers are slated to participate as workshop presenters at the Conference.

The Purposes of Training

Papert and his associates emphasize that the purpose of the training program, in all three years, has *not* been to train teachers in technology, *not* even necessarily to have teachers acquire a specific technical proficiency with LOGO. Rather, they say, the major objective is to create an entirely different educational culture at Hennigan School where computers and LOGO become almost invisible tools with which students learn by "constructing" their own learning environment and knowledge structures. The underlying assumption of Dr. Papert's use of LOGO is that the creation of a "LOGO culture" will result in the spontaneous and natural integration of computers throughout the curriculum. Other purposes of the project include:

- conducting research on the role the teacher plays where a child "constructs" his or her own learning environment;
- exploring how teachers can use LOGO and LEGO/LOGO in this new culture;
- observing what facilitates or increases teacher acceptance of the new culture.

First Year of Formal Training, Summer 1985

In year one the training clearly addressed comfort issues with regard to technology. Training was provided to familiarize the teachers with the project computers. Additional training addressed the use of the network system, sign-on procedures, printing routines, etc. A major effort was also undertaken to generate, on the part of the teacher, an understanding of the Papert educational philosophy as contained in Mindstorms: Children, Computers and Powerful Ideas. This was seen by the MIT staff to be the central focus for preparing teachers for the new culture. The use of LOGO in implementing that new culture was also covered in teacher training and teachers were exposed to LOGO as a programming language. Demonstrations of the LOGO language were followed by unstructured, hands-on practice with LOGO. Technical proficiency was not, according to MIT staff, a necessary outcome of the learning process (then or later). Familiarity and acceptance of the "computer culture" was seen as the priority. It should be noted that elementary students also attended the first summer training, in part because trained students were seen as a mechanism for helping train teachers.

Second Year, Summer 1986

In year two, results of year one were shared. Additional discussions on the use of LOGO in developing the "culture" and more hands-on work with LOGO completed the training plan. Teachers could choose from two basic levels of training: "beginning" and "advanced." Trainers reported that while there were two separate groups when summer training began (and one-third assessed themselves as novices after one year of the project), by its culmination the groups merged. Teachers were not exposed to any programming language other than LOGO. The educational philosophy of the project continued to be addressed in both the formal and informal training. Also, additional efforts were made to increase literacy in LOGO. Overall, this program was perceived by interviewed teachers and MIT graduate students as very similar to year one. No elementary students participated in summer training based on a joint decision of Hennigan teachers and MIT staff.

Third Year, Summer 1987

As in the first two summer training sessions, LOGO and its attendant products dominated the specific software training provided to the teachers at Hennigan School in year three of summer training. The first week was more structured than in previous years and focused on helping teachers develop LOGO products. The presenters modeled certain LOGO activities such as how to construct a simple data base using LOGO. A variety of product development assignments were given to the teachers. The assignments demanded slightly more advanced programming and reasoning skills than teachers had been exposed to previously. Upon completion, a discussion was held concerning the routes the teachers had taken to their solution, and of the stumbling blocks along the way.

In the summer of 1987, the teachers were first exposed to LEGO/LOGO and began to explore its use. The MIT graduate student trainers shared some basic knowledge about forces and gears before turning the teachers loose in an unstructured work session in which they were to produce a product using LEGO/LOGO. Few teachers reached the completion stage given the limited time available for exposure to LEGO/LOGO.

Throughout the training, short discussions started and ended each day. Topics raised included: how to go about improving one's ability to intuit the "correct" answer to a problem; the power in *naming* an object, or a subroutine, in LOGO, etc.

At lunch on each day of training, MIT graduate students presented reports on the preliminary findings of their research. A discussion followed these presentations in which the MIT students were the predominant discussants. There was also a presentation by representatives of the Apple's Classroom of Tomorrow program (ACOT) teachers from Cupertino, Nashville and Memphis participated). This presentation generated extensive and vigorous discussion among the MIT graduate students and the ACOT teachers about the merits and wisdom of saturating a class with computers as Apple has done in its six ACOT sites.

Teacher training was also provided on how to use LOGOWriter as a student application for word processing and LOGO as a math lab.

A summative discussion was devoted to the joint experiences of the teachers and the MIT students in using LOGO "across the curriculum" as a method of integrating the curriculum. Successful examples were discussed and ideas exchanged for addressing that objective in the ensuing year.

Informal Training

Several informal training strategies are used:

- In 1985-86, teachers and MIT staff held lunch meetings to discuss curricula and techniques. In 1987-88, the meetings are planned to continue, though after school.

- MIT hired a visiting teacher from Canada who was well-versed in LOGO and music during the 1986-87 school year. This teacher served as a daily model for other project teachers.

- MIT graduate students reported seeing one of their major roles as "planting seeds" and being catalysts to the project teachers and students. Often they direct their training toward students. They feel teachers profit by this "meta-level" modeling and are able to "reconstruct" the MIT graduate student-elementary student relationship.

Informal training is also conducted throughout the school year, predominantly on an individualized basis. Harry Nelson, a former MIT graduate student and now employed by Franconia College in New Hampshire, serves as a consultant, visiting the project approximately twice a week during the school year. One of his responsibilities is to provide assistance to the teachers in the program and to serve as a tutor/trainer of the teachers. In addition, the MIT graduate students who are present at Hennigan School on any given day, act as informal trainers for teachers and students, especially when they encounter difficulties in LOGO. This includes helping teachers and students with LOGO issues such as animation or recursions. They also assist with technical problems associated with the hardware or software and provide psychological support to teachers initiating a new project. An unstructured and informal approach to creating a computer culture is seen as the most effective way to achieve a level of comfort with the program and a basic understanding of the program's mechanics and potential classroom applications.

The MIT staff and project teachers also report using elementary students who had mastered LOGO, or at least achieved a mastery higher than the teacher, as coaches and tutors during the course of the year.

All project teachers have PC Jr computers at home (although students do not). Teachers reported that this access was of great importance in their self-education.

The Trainers

The training team in each of the three summer programs has included Dr. Seymour Papert, the MIT graduate students that are central to the project, other project staff, and a variety of consultants and presenters. For the most part, trainers have not been practicing teachers in the K-6 grades (although by years two and three many had acquired considerable experience in teaching LOGO and LEGOLOGO at Hennigan School). The MIT training team members are exceptionally proficient in the use of LOGO and LEGOLOGO, and they are very motivated by the related research questions.

Training Participants

On any given day in the summer training sessions of 1987, the attendees at the training workshop included the 15 Hennigan School teachers, several non-project Hennigan teachers, a number of individual visitors, a four person delegation from the Apple

Classroom of Tomorrow project, and the assistant principal of Hennigan School. The composition of the attendees in previous years was reported to have been much the same.

Incentives For Teachers

Monetary incentives for teachers to participate in the training were limited. In fact, participation in the Headlight program, which carried no monetary rewards, *required* that a teacher participate in the training offered the first two summers, and in the first week of training in the summer of 1987. During the project's first year, teachers could get college credit for the summer training at no charge. In year two, a charge was initiated and very few teacher participants paid for credit. In 1987, there were no provisions for teachers to get credit for the summer training.

During the course of the project, the teachers reported that they felt rewarded by the recognition attached to their program; by being able to have a computer at home; by working with Dr. Papert; by the excitement of the many distinguished visitors to the program and their school; and by being able to participate in the LOGO Conference without cost.

IMPACTS AND FUTURES

On The Teaching Staff

Many teachers felt that their own skills in LOGO were still deficient, despite three summers of intensive training and two years of using LOGO, or being associated with the MIT students using LOGO and LEGOLOGO in their classes. Of the teachers interviewed, most reported that the project has had little impact on them as teachers, either in their attitude toward teaching or their approaches. On the other hand, MIT graduate students reported some research data collected thus far suggested a change in teacher attitudes about their roles and teaching styles.[1]

Interviews we conducted with the teachers raise questions about the extent to which the teacher has achieved the goal of using LOGO as a mechanism for delivering an integrated curriculum, at least in comparison with the efforts in Jefferson County, Alabama; Albuquerque, NM; and in some local school districts in Minnesota, such as Shakopee, Blue Earth, and St. Louis Park. Overall, while the MIT staff appear to be very assimilated in the new culture, most Hennigan teachers do not.

Teachers were clearly conscious of the fact that they, along with their students, were objects of considerable research, but they were not at all uncomfortable with that. The results of this research, however, have not been published or released.

The teachers in the LOGO project reported some interest on the part of other teachers in the Hennigan School in the LOGO program. Since there has been only one opportunity for a new teacher to join the program, it was difficult to estimate how strongly non-project teachers want to participate. Project teachers described many of their non-participating colleagues as "scared;" not wanting, or unable because of other commitments to participate in the mandatory training; and unable to see the link between their teaching (either style or content) and that being done in the LOGO project.

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[1] This research, which is still in progress, was not made available to us. It is possible that the teachers are not aware of changes in their behavior, that the MIT research would be challenged by the teachers were it available to them. We cannot explain the apparent discrepancies between the teachers' opinions and the MIT research without a review of that research.

Some teachers expressed a desire to explore "the world beyond LOGO." One teacher reported that she was able to reduce, in year two, the amount of time her class spent with LOGO without decreasing the abilities of her students. She was convinced, however, that the students in year two were brighter than those she had in year one.

All of the teachers see LOGO as an effective way of addressing English as a Second Language, and several are participating, quite excitedly, in the development of a Spanish language adaptation of LOGO.

One observation which we would make on the basis of our talks with teachers across eight sites is that the teachers at Hennigan School seemed less excited about about their activities than their counterparts in Minnesota, Albuquerque, and Jefferson County, Alabama. The summer interview setting, away from the direct interaction with students and therefore "lessening the computer culture," may have contributed to this affect but overall it seems to reflect a certain detachment from the project on the part of the teachers involved. They seem to see themselves as onlookers: objects of research; observers of MIT students teaching their classes on many occasions; restricted in the way in which they can mold their teaching beyond LOGO.

On Students

The teachers consistently reported their students had benefited from participation in the project. They reported the primary benefits of LOGO were improvements in certain skill areas (math, spatial skills), reasoning, problem-solving, creativity, self-esteem and self-confidence, motivation, and excitement.

On the Organization

Whether the project would or could continue in its current configuration without the external intervention of MIT seems doubtful. According to the assistant principal, internal monies are not available to support the project, but he indicated the school would be committed to continuing the project in some form after the termination of external support. There have been no efforts to expand the program to the entire school, nor has the school or MIT staff engaged in any extensive planning as to what happens next. The project is seen as a pilot project not requiring fiscal participation by the school or district. Expansion could not take place without additional funding and the district has not yet taken a position on this issue since the pilot will supposedly provide data crucial to any future decision in this regard.

One change that undoubtedly would occur would be a move away from a concentration on LOGO when working with computers. That has already occurred, on a small scale, in the non-LOGO project part of Hennigan School, and the teachers in the project report an increasing desire on the part of their students (and in many instances, themselves) to use the computers with software other than LOGO. They report a reluctance to do so, however, because of the concentrated focus on, and commitment to LOGO, by the MIT staff. Part of the teacher reluctance to use other software may be that they are still uncomfortable in using computers where structure and support from MIT staff is not available. The teachers also say they believe the MIT staff does not want them to use any software other than LOGO. The MIT staff denies this and one teacher uses other software extensively.

POLICY ISSUES

Equity

Teachers report that some non-project teachers and some parents have raised the question of equity ("Why can't my child get in the LOGO program?"), but it is apparent that it has never been a serious operational question at Hennigan School (given the relatively high 1:21.5 ratio of computers to students in the rest of the school). More often the issue is raised concerning the equity for the children in the project who have enjoyed a rich teaching environment, filled with computers and LOGO, who will not find that same environment when they graduate from Hennigan School and go to a "non-computer" middle school environment where computers and LOGO are not so readily available. This raises a serious policy issue for the Boston Schools and for the funders of the original project, but one which, for a variety of reasons, is not being addressed. This issue is common to all sites, but especially those sites in which the changes in the learning environment have been most extensive and observable.

Training

We believe this project raises several issues about training. In this project the trainers are predominantly MIT staff or MIT selected consultants. Training at Hennigan School has been focused on creating a computer culture in which computers and LOGO contribute to a student's construction of his or her own learning environment. Although some attention has been paid to the integration of LOGO throughout the curriculum, and to using LOGO as an instrument to achieve an integration of the curriculum, training has not been a high priority item.

The fact that the training is mandatory at Hennigan School seems irrelevant since the training is so closely connected with the issue of participation in the project and that was entirely voluntary.

Another policy issue, or concern, raised by our observations is the extent to which responsibility for using LOGO truly has been transferred to the teachers. A similar issue was raised in other settings where teachers take their students to a computer lab and the aide, or the computer specialist, teaches the students and uses the computer. Less importance is attached to the use of the technology by the teacher since there is someone else that will do it. Although that outcome is not at all the same as the outcome at Hennigan School, we do believe the extent to which the teachers are responsible for LOGO and LEGOLOGO teaching is a serious question at Hennigan School.

MIT staff play a crucial role in this project. They have provided most of the administrative leadership as well as the intellectual leadership. This again raises serious questions about what policies could assure the replication or expansion of this project without those essential inputs from an external source.

In addition, there is no specific timeline for the Hennigan project. According the MIT staff interviewed, no phasing-out process has been discussed as yet.

Funding

As elsewhere, the dependence on external funding, in this case complete external funding, raises serious questions about the capacity to replicate and transfer the program, at least to the extent that allocation or reallocation of significant funds would be necessary to carry out an expansion or duplication of this model. This comment applies, of course, to a replication of the entire model - not just the training involved. The training was a part of a larger whole and cannot be evaluated separately.

Purposes of Technology Training And Instruction

The Hennigan School project indirectly addresses curriculum integration. Curriculum integration is certainly critical to the project, and is seen in that light. But MIT staff believe that the "correct" use of LOGO will bring about integrated approaches to the curriculum and the use of LOGO throughout the curriculum. If an integrated approach to the curriculum is desired, the project must clarify how LOGO is a holistic means of integrating a computer culture within the existing school culture rather than creating a separatist "culture."

Certification

Several teachers at Hennigan reported taking courses in Basic, and participating in the LOGO project, in order to increase their job protection by becoming a "computer specialist." The Boston Public Schools require, among other things, completion of a Basic programming course in order to designate a teacher a computer specialist. Other sites visited for this study suggest that certification of specialists in technology is inappropriate, at least at this stage of the development of educational technologies. We believe this case study supports that conclusion.

Other

At other sites in this study, the use of laboratories for computer instruction has raised important policy considerations. At Hennigan School, LEGOLOGO has been used in classes and LOGO in a "cluster" setting. It is our opinion that a true integration of the use of technology as an educational tool can only occur in a classroom setting, where that tool is plentiful. We do not have blackboard laboratories, or pencil laboratories. We do have "book laboratories," but checking out library books is easy and encouraged. The "cluster" environment at Hennigan School does not appear as disruptive as the laboratory approach elsewhere. Even though the arrangement of computers at Hennigan is technically in a laboratory, the easy access from all classrooms circling the computer pods makes this transcend the typical lab issues. In addition, the high ratio of computers to students (1:3) makes access easy.

CONCLUSION

Training teachers to use technologies is reported not to be the objective of the Hennigan School project. As the MIT staff made clear, the objective is to create a different educational culture, a culture which Seymour Papert calls "constructionist." By this he means a culture in which participants construct their own learning. They build their knowledge from the tools they use. Two important tools in such an environment include LOGO and computers, but they are not the only tools. Music and word games could also be used as tools. In the view of the MIT staff, the development of this culture will lead to an integrated approach to the curriculum which in turn will lead to changed teacher behaviors, not because teachers are taught to behave differently but because they want to behave differently. The students learn differently because of the culture in which that learning takes place.

In the case studies conducted for this project, we found that the integration of the use of computers throughout the curriculum has become a common goal. But that objective, unlike the Hennigan project, is the result of training in how to use computers and then the use of them across the curriculum.

At Hennigan, the development of a different educational culture comes first. It is assumed the integrated use of computers will occur naturally. That may be true for some teachers and students. We do not know since we were unable to observe this process extensively. But it does not appear generally true for the Hennigan teachers, especially where they have readily available help from the MIT staff.

Furthermore, in our other cases, the use of computers throughout the curriculum has led to serious consideration by teachers about what constitutes effective teaching and learning. Although we have not discussed these outcomes in this study, the questions raised about teaching and learning are similar to those raised by the "culture" of Papert and his associates. In other settings the process seems to be training in technology - followed by the use of technology in an integrated manner - followed by questions relevant to a new educational culture. At Hennigan the culture supposedly comes first. It may be that other sites will reach the new culture before Hennigan does, primarily because it is the product of the teachers learning and experience and not imposed from outside.

Other issues flow from this analysis. If a new culture is the objective at Hennigan School, can it be established - or survive - when the culture elsewhere at Hennigan, and throughout the Boston Schools System, is the old culture? Can it be transferred elsewhere? Can the project be replicated? Possibly, with adequate funding and the availability of a sufficient number of those "properly acculturated," but the properly acculturated seem to be limited to Papert and his MIT followers.

Another issue that arises is how to know when the objective desired has been attained. If we want to know when teachers have achieved technical abilities, or when they begin to use the computer throughout the curriculum, we can determine that relatively easily. But if we want to know whether or not they have been acculturated into Papert's "constructionist" culture, we have much greater difficulty. The MIT staff was unable to provide us with any evidence to demonstrate, or any criteria for demonstrating, whether or not the desired culture had, in fact, been attained.

Although the Hennigan project staff alleges that they treat teachers as peers, that teachers **are** necessary, our observations lead us to conclude that they actually want to transform teacher behavior. They say this is the **product** of the new culture, that the teachers want to change. The "magic" of the culture will work. We ask, given that a new culture is the central objective of the project, which really comes first?

Control over the development of the new "culture," and the information available about it, is vital if a new "culture" is to be achieved and survive. These issues are raised by the Hennigan project, but are beyond the scope of this study.

FOR ADDITIONAL INFORMATION

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The primary written material relating to the project is:

Papert, Seymour. Mindstorms: Children, Computers and Powerful Ideas, New York: Basic Books, 1980.

THE MULTI-MEDIA PROJECT OF JEFFERSON COUNTY, ALABAMA
"Lets Make A Movie!"

INTRODUCTION

Jefferson County, Alabama, School District is a suburban district of 46,000 students surrounding Birmingham. The district employs 2,600 teachers working in 72 schools. Fifteen percent of the student population is non-white.

In May 1986, Fred D'Ignazio, author of over a dozen books on computers, editor of Compute magazine, and developer of the "Multi-Media Approach" to using technologies in schools, contacted Dr. Ronald Jones, Director of Staff Development for the Jefferson County School District. D'Ignazio proposed conducting a series of training workshops on the "Multi-Media Approach." After some discussion with D'Ignazio, and with an understanding that the training proposed would be significantly different from any other training the district had ever held, Dr. Jones agreed to sponsor a single workshop to explain the project and to see whether there would be sufficient interest to continue with additional activities.

Twenty teachers attended the first workshop in late summer 1986, attracted solely by a flyer distributed to teachers in the system. Attendees cited many reasons for interest: a training session that sounded "different;" curiosity about computers and multi-media uses in the classroom; a chance to learn more; the opportunity to see a celebrity from Good Morning America;[1] and/or because they were urged by a friend to accompany them. Attendees received no credit or pay for attending the free workshop.

Following this training session, strong support for a second wave of training emerged, and work began on implementing D'Ignazio's "sandbox," or hands-on, multi-media project.

In September, 1986, D'Ignazio conducted a series of six awareness workshops for teachers, students, and parents. The focus of these sessions was on the particular equipment and software central to the project. This collection of equipment is referred to as a "multi-media cart" consisting of: a music synthesizer, a video camera; a digitizer; an Apple II computer; print and graphics software; and a videotape editing machine.[2]

At the same time that the six awareness workshops were being conducted, an open invitation was issued to all the district's schools to submit a proposal to participate in the "multi-media project." Twelve schools from Jefferson County (nine elementary and three middle schools) and one elementary school from a neighboring district, Vestavia Hills, responded. All were included.

Even though the multi-media project was launched with great ceremony and press attention in the fall of 1986, most of the schools were not fully equipped with multi-media carts until January 1987. By the time the interviews for this study were conducted, the program had been fully operational for approximately six months.

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1. D'Ignazio had been a recent guest on that program.
2. D'Ignazio even published an inventory and price sheet for the multi-media project which included a "Scavenger's Special" - a list of equipment to borrow from teachers, students and parents. See Appendix A.

KEY ACTORS AND EVENTS

The School District

D'Ignazio[3] was the "fireman" behind the project. Crucial to the project's success has been his excitement, enthusiasm, risk taking, as well as the fact that he was external to the project, that is he was not employed by, or affiliated in any permanent sense with, the Jefferson County Schools. But the project could not have happened without the "systems-wise" support of Dr. Ronald Jones. Dr. Jones played the role of "brakeman" to D'Ignazio. He insisted that the project focus on a limited set of objectives. He located D'Ignazio's office in a school where the principal was particularly supportive. He saw to it that key principals and teachers were involved. Dr. Jones was assisted at all stages in the project by Nez Calhoun, Director of Public Relations for the District, who played a central role in getting immediate and continued visibility for the project from local print, television and radio media.

Despite the strong support for the project from Dr. Jones, and despite the widespread publicity for the project generated by Ms. Calhoun from the Superintendent's office, Board and Superintendent recognition of the project did not occur until July 1987, when Dr. Jones made a presentation to the board summarizing the training activities.

Building principals were key actors in the process, however. Six principals were involved actively in the project, supported their teachers enthusiastically, and creatively used the project to gain parental support. One principal was extremely reserved in his support of the project, and only because of an unusually strong commitment on the part of the key faculty did the project have a positive impact. The rest of the principals were reported to be relatively indifferent.

Over 75 teachers from 13 schools were directly involved in the project, and an additional 25 teachers were partially trained and using the multi-media approach by the end of the first year. In addition, a second elementary school in Vestavia Hills had begun a multi-media initiative.

The Business Community

The business community played a key role in the project. It would not have happened save for the generous contributions of Apple, Sony, Alabama Power, and others. In addition, the local television stations and print media gave strong support to the project in its early stages.

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[3] It is essential to understand that much of the enthusiasm, excitement, and energy which characterizes this project stems, we think, from the personality of D'Ignazio and his ability to generate unusual loyalty and effort on the part of teachers. The teachers, students, parents and administrators in Jefferson County call him "Fred", "the elf", "the wizard". Although it is not our contention that a "Fred" is a requirement for the success of other projects, we are convinced that his ability to create an atmosphere which was unique in its intensity and excitement does help to explain why Jefferson County could do what they did so quickly and with such little financial support.

TRAINING

Purposes

There were six purposes to the training:

1. to help the teachers incorporate a variety of multi-media technologies (e.g., radio, TV, desktop publishing, and telecommunications) into the curriculum (specifically, into lessons in math, science, language arts, and social studies);
2. to "encourage students and teachers to adopt an experimental, problem-solving approach when using computers, video equipment, digitizers, and other high-tech machines;"
3. to convince teachers that a hands-on approach worked well for their students and themselves, no matter what the grade level;
4. to assist students and teachers to become more thoughtful, critical media consumers;
5. to focus on training teachers (and subsequently students) to produce a product that required full use of critical thinking skills;
6. to give schools a low-cost, teacher-centered opportunity to be on the "cutting-edge" of technology.

Planning for Training: The Serendipity Model

In some sense the project, as well as the training, was unplanned. The project was understood by D'Ignazio in a general way at the beginning, but it was continually reshaped as new opportunities presented themselves. During the course of the project, Dr. Jones pushed D'Ignazio to think about integration into subject areas, and forced him to deal with issues of follow-up. He also tried to place some limits around the creative excursions of D'Ignazio's mind. But through it all, both individuals consistently sought to use technology to improve instruction within the current curriculum. Technology, in and of itself, was unimportant. Instead, its importance lay in its power as a vehicle to achieve other educational goals. The ideal was to make the technology as transparent a tool as possible.

The Trainers and The Training Process

D'Ignazio was the key trainer. He was assisted in the workshops by one student and two professionals serving as technical consultants. But D'Ignazio's training approach was unique. His first step was to have the teachers open the boxes of equipment that made up a "multi-media" cart. Then he gathered up the instructional manuals and threw them in the trash can. Then he said, "Let's make a movie." The consultants were forced to act as consultants - to respond only to requests from teachers for assistance. The teachers had to begin using the equipment immediately. The teachers reported they found out a lot of things about the equipment that the "expert" consultants did not know. And they also were cognizant of the difficulty the experts had in "not doing it" for the teachers.

Following the assignment to make a movie, and some experimentation with the equipment, the teachers had to plan a movie and videotape it. They decided on a movie about the heat wave then engulfing Birmingham. After some discussion they decided to focus on the zoo, specifically on how animals kept cool.

Once the teachers had made a movie, they had to implement the multi-media approach into their classrooms. The procedures used were the same that had been used in their training: let the students devise a product, select a topic, and use it to integrate materials from several subject areas.

During the implementation with the students, the teachers became aware that their relationship to their students paralleled the relationship of the technical consultants to themselves while they were being trained. When introducing the multi-media approach in the classrooms, the teachers found it difficult to allow their students to learn by doing, just as the technical consultants had found it difficult to allow the teachers to learn by doing. But the teachers succeeded, and were greatly pleased with the results.

Two other elements made up the formal training effort for the multi-media project: key teachers were appointed in each participating building; and D'Ignazio made several video tapes, especially about how to use the computer software, that were widely used by teachers.

In summary, the key elements to the formal training were: a hands-on approach; immediate immersion in producing a product; the availability of "consultant experts" for assistance (often students); cooperative learning through projects in which students and teachers were partners.

Informal Training

It is important to understand that most of the teachers who participated in the project did *not* take part in the formal training program described above, even though it was brief. The project, once implemented in the classroom by the teachers who had participated in the training, spread rapidly to other teachers and other classrooms. In all cases participation was entirely voluntary.

This second wave of participation was by teachers who became excited because their peers were excited, and because, in a sense, extensive training in the use of equipment was not required. Using the equipment in the classroom, and learning from that process, was really the key training approach.

There are several other explanations for the rapid and extensive spread of the project beyond those formally trained. First, comfort in the use of technology was highly emphasized and well established. It is our judgment that this was easier with video since a product could be immediate, it could be "funny," and "mistakes" often yielded unusual and entertaining results. Comfort was enhanced by the dynamic personality of D'Ignazio, and by the surprise visits, as cheerleader, that D'Ignazio made to the teachers' classrooms.

Second, the project easily allowed for "specialization" on the part of teachers. Some teachers emphasized the use of video cameras, others concentrated on the keyboard synthesizer, computer, modem, digitizer, print software, graphic software, or video editors. But all were familiar with and could use all of the equipment.

Because specialization was possible, because participants did not have to know everything, three things happened: more teachers participated; technical training became much less important; and a cooperative learning approach became central to the project.

Third, the willingness to learn from someone else in the project, and to rely on someone else's expertise extended to the teacher's relationships with their students. One of the most impressive findings of our interviews with teachers (and two students) in Jefferson County was the level of acceptance and comfort that both teachers and students had in learning about how to use the technologies from each other.

Fourth, computer programming was not dealt with significantly, and the use of software and applications were dealt with only secondarily, as tools necessary to complete a project. Video tapes explaining how to use the key software were available for review at any time. In addition, students and teachers were available as technical consultants to all phases of the project.

Finally, the project, from its inception, focused on the teacher's curriculum, not technology. There was never any question that the central reason for learning about and using the technology was to enhance the teaching of the curriculum. It was never believed that learning about the technology was an important objective.

FUNDING

The multi-media effort of Jefferson County had the lowest per capita expenditure of the sites visited for this study. In essence, no local funds were used in the project. It operated on a shoestring. Five thousand dollars was paid to D'Ignazio from Title 2 funds by the Jefferson County School District. The rest of his time he contributed to the project. (It was, in essence, a full-time commitment for nine months.) Donations of equipment and software were received from Apple Computer, Inc. (approximately $50,000), Sony, and Yamaha. The Alabama Power Company contributed $1,000 and the use of their corporate auditorium for a May festival. Local computer and video stores contributed printer ribbons, cables, video and audio tape. Teachers and students brought in tape recorders, and supplemented other equipment from their own resources. Dr. Ronald Jones used his own money to purchase the computer used as the host computer for the multi-media network.

IMPACTS AND FUTURES

The project had many impacts on the participating teachers, students, staff and schools.

Teachers

In buildings with principal support, the use of the multi-media approach, as noted earlier, spread like wildfire. The approach generated enormous enthusiasm about the creative uses of technology and the roles technology can play in teaching. The project radically increased the team approach to teaching and curriculum planning. Several cases of "burnout" were reported to have been reversed. One teacher put it this way: "Before Fred started the multi-media project I was burnt-out as a teacher and was looking for another job. The multi-media project has made it possible for me to go on teaching for ten years." The teachers reported that their teaching efficiency, and their ability to approach the curriculum in an integrated manner, had been significantly improved. Teachers also spoke of being more willing to take risks, to reveal that they did not know everything, and that they were learners too. The teachers bought their own equipment (computers, video cameras, editing VCRs, music synthesizers) in significant numbers. Teachers began to use the video camera as a substitute for field trips for which there was no money, and, in so doing, the technology became a tool to achieve some equity in experiences. Students were also encouraged to take field trips with the camera and to share them with their fellow students. New types of "field trips," especially interviews, were undertaken.

The teachers who participated in the multi-media project reported that they: felt good about having mastered the use of a variety of complex technologies in a short period of time; were excited by their students' use of the technologies to produce products which involved a thoroughly integrated approach to the curriculum; began to see their teaching activities in a different light, understanding that they had "much to learn from the kids" and that neither they nor the kids had to know it all - they just had to be able to try it out, ask each other, know how to find out the solution to the problem.

Students

The teachers reported they were especially pleased with the multi-media project because the self-confidence, creativity, and problem solving capabilities of their students increased so dramatically in such a short period of time. Teachers and students alike reported increased interest in school, increased self-confidence and esteem. The teachers reported an enormous increase in creativity, and in problem solving skills on the part of their students. An increased willingness on the part of students to work cooperatively, as a member of a team, was also reported. Students were the sources of many new and, according to the teachers, exciting ideas that linked various aspects of the curriculum together. And students demonstrated, in numerous cases, that they could complete assignments more quickly, and with greater accuracy, than previously in order to generate additional time for use with the multi-media equipment. Several teachers reported that students insisted on a faster approach than the teachers had planned and that all students were able to move faster than anticipated.[4]

Parents

Parents were very supportive though some had initial questions about why the children were having so much fun in school. Parents in the project, in part because they were reached with new tools and student products, became much more involved in the activities of the school. Parents have also begun to bring pressure to expand the program to other schools.

The Community

The multi-media products produced through the project were used successfully with parents and the general public to increase support for the program. The level of school pride was also positively affected. The project has increased the visibility of the school system. Publicity and attention in the form of television and radio talk show appearances increased for students, teachers and administrators.

The Board

The School Board was uninvolved in the project until July 1987. In July, D'Ignazio moved to East Lansing, Michigan. Nez Calhoun and Dr. Jones arranged for a testimonial thank you for D'Ignazio at the July Board meeting. The Board expressed strong pleasure with the results of the project and wished D'Ignazio well. In August, while conducting interviews for this study, we were joined for some meetings by the senior member of the Board who expressed surprise at the extent of the project, great pleasure with the enthusiasm and dedication of the teachers who were involved, and much pride in the positive impact on the children in the participating schools.

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[4] In interviews held with two multi-media teachers in January 1988, one interesting new outcome was reported: students now discuss the television they watch during their leisure hours in an entirely different way. They analyze it, critique it, discuss it from a production standpoint. The teachers believe this is an especially positive development with significant implications for leisure habits and the development of intellectual, higher-order thinking skills.

In Vestavia Hills, School Board involvement came much earlier, although not at the start of the project. In January 1987, the principal of the participating Vestavia Hills Elementary School heard that one Board member had expressed concern that the multi-media project appeared to be just "play" and not educational. She quickly requested permission to make a presentation to the Vestavia Board at the next meeting. She then arranged for two of her participating teachers to speak at the meeting. The teachers decided instead that the students should speak and show their products. On the day of the Board meeting, the program was explained and defended by a third grader. He talked about the products which his class had completed, what he had learned as a result, how he felt about school and his work now that the multi-media program was there. The Board responded extremely positively and continues to be supportive.

POLICY ISSUES

Institutionalizing the Project After The Key Personality Departs

D'Ignazio's departure to Michigan, after the project had been in operation for less than a year, raises a particularly important question: can the project be stimulated and maintained in the absence of D'Ignazio? Several visits to Alabama are currently being planned by D'Ignazio, and the multi-media electronic network that runs on the computer donated by Dr. Ronald Jones is already being used extensively to continue D'Ignazio's linkage to the project. In addition, D'Ignazio will team with several teachers in external training sessions and conference presentations. [5]

Funding

It is in the area of local financial support that the most serious policy questions arise. The district cannot escape parental and faculty pressure to expand the program. Building level planning to expand the program is already underway in at least four sites.[6] But PTOs and the generosity of teachers, staff, and students cannot sustain the program in the long run. Ultimately, local funds must be used. The process by which these funds can be generated has not been resolved.

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5. Several developments indicate that the program is not dependent on the long-term presence of the key personality. Consultations with administrators and teachers in Jefferson County, and with D'Ignazio, conducted between September 1, 1987 and February 1, 1988 indicate that the project continues to be effective, to expand, and to enjoy the wide support of faculty, staff, students and parents. In fact, the teachers in Jefferson County report that they welcome the less frenetic pace of the program this year. Another bit of evidence supporting this conclusion comes from Michigan where D'Ignazio now resides. In January 1988, D'Ignazio trained faculty from four schools in Royal Oak, MI. D'Ignazio provided three days of intensive training supplemented by two afternoons of follow-up. The reactions from the participating faculty have been so positive, according to a telephone interview with the Director of Curriculum of the Royal Oak Schools in February 1988, that Royal Oak has decided to at least double the size of the project next year. They are certain they will be able to conduct the program and expand it with no further assistance from D'Ignazio. They do plan, however, to keep in touch with him on the developments in Royal Oak. They also report that Royal Oak faculty are preparing to share the results of their multi-media efforts in a one day multi-media training session which they will conduct for the Michigan ASCD Elementary School Network in April 1988.

6. In January 1988, the Principal of Cahaba Heights Community School made a major investment in

In Jefferson County, 67% of the $100 million budget comes from state funds. For the past two years the state has had shortfalls in their funding (all concentrated in the last quarter) of up to 10%. This has forced local school systems to borrow heavily. Payrolls are pared to the bone. For example, Dr. Jones is *the* faculty development person for the district. Resources are limited. While the *expected* allocation for supplies per teacher was $250, the actual allocation was only $25. That the multi-media project was successfully implemented is a minor miracle. Sustaining and expanding it may call for a major miracle. During the first year of the project there was no budget allocated for the project. The project will not continue to succeed if significant resources are not allocated to it in the future.

Equity

Equity has not yet surfaced as an issue in the multi-media project, but as its success becomes more widely known, serious questions are bound to arise about why it is not available in all schools. At the building level, the teachers have developed quite elaborate mechanisms to share equipment and to engage in planning that maximizes the effective use of the equipment for the participating teachers. But as the number of participating teachers expands, so, too, will the pressure on the use of limited equipment.

Training

Training has never been mandatory so no policy issues have arisen in that regard. In fact, training proceeded without any policy considerations other than a clear framework for the type of training to be undertaken and the purposes of the training. Although the project contributes to our broader understanding of the policy issues surrounding the use of technology for educational purposes, no specific policy questions in the area of training have arisen for this project.

Coordination and Planning

Planning was minimal for the project and most of the coordination in the first year was shared by D'Ignazio and Dr. Jones. In 1987-88, Dr. Jones will have to assume responsibility for all of the planning, and the demands for planning will be more extensive. Coordination of the program will continue at the building level and will not have to be a primary issue at a district level this year. But that cannot be postponed more than one year. Also, as the project becomes more visible (that is already happening, as evidenced by a steady stream of requests to teachers to make presentations and to consult other districts, not to mention this study and its impact), the pressure for superintendent and Board support will increase. Board support is quite likely, at least verbally. But will the money be there as well?

Integrating Technology Into the Curriculum

Integration of the use of technologies throughout the curriculum, and using technologies to integrate the curriculum both occurred to an unusually high degree in the multi-media project. Certain elements fostered the emphasis on integration: the purposes of the program and the training; the orientation and support of key principals; the orientation of the teachers; and the use of a team approach. The program's greatest effectiveness, at least in Jefferson County, appeared at the elementary level.

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additional multi-media equipment from school based resources.

Mandates and Reforms

Alabama has two pieces of "reform" legislation which affected, in part, the multi-media program. Teachers were conscious of specific curricula mandates. Some responded by being concerned with the specific time demands, e.g., spend so many minutes on "Objective A." Most teachers in the project were unconcerned. They understood, and were ready to defend their use of, an integrated approach to teaching. And they felt buffered and protected from the impact of the reform legislation by their principals, especially those highly supportive of their participation in the program. The fact that principals allowed teachers to be flexible, even within curriculum requirements, is a key explanatory factor of why this project succeeded in spite of state rules and regulations that in other situations would stifle the creative approaches used by the teachers participating in the Multi-Media project of Jefferson County.

The second "reform" that concerned teachers were new state evaluation procedures that mandated timed observations. Some asked, "What if the camera breaks, or won't work during my four minutes of observation?" Others said (and vigorously) "I don't worry about it. Let them check my students scores. Let them ask my students. Let them observe me as a whole." A supportive, buffering principal helped transcend this situation constructively.[7]

This case clearly indicates that "reform" can stifle and undermine, in the absence of a willingness to take risks on the part of the teacher and/or the principal, the successful use of technologies in education and the training of teachers for those purposes.

Labs vs. Classrooms

The multi-media was a classroom-based project, with a team approach. It would not have worked in a laboratory arrangement.

Other

Teachers reported that there was a need for long blocks of time with students to make the multi-media approach work.

CONCLUSION

The Multi-Media Project of the Jefferson County Schools, was judged by multiple audiences as a resounding success.[8] Components of the approach can be replicated elsewhere, and technologies can facilitate an integrated approach to learning. It is relatively inexpensive. But it requires tremendous dedication and time on the part of principals and teachers to take risks, to act collectively, to include students as equals in the learning of how to use technologies, and to modify traditional approaches to teaching.

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[7] In February 1988, the Alabama Senate unanimously passed legislation rescinding Alabama's career ladder evaluation procedures. House action, and review by the Governor, have not yet occurred.

[8] As is the case in all of the case studies reported here, very little "scientific" evaluation has been undertaken on the impacts of the projects using "hard" data by anyone, including the authors of this report. Most data we used, and that is used in all of the projects we studied, is short-term, anecdotal data based largely on interviews. We do not consider this a problem. In fact, these data probably give us a more accurate reading of any specific project given the highly volatile nature of the personal relationships that are a key explanatory factor in all the case studies.

The excitement generated among the public, the administrators, the teachers, and the students leads one to the conclusion that this project was a success beyond the dreams of the original proponents. Certainly, it produced significant learning outcomes among the students and teachers, and it led to an integrated use of technologies throughout the curriculum. It is also an example of a model from which other schools can learn. We encourage efforts to replicate, disseminate, evaluate, and institutionalize projects of this type.

FOR ADDITIONAL INFORMATION

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The principle written material regarding the program includes:

D'Ignazio, Fred. Multi-Media Classrooms: A Classroom Kit. East Lansing, MI: Multi-Media Classrooms, Inc., 1988.
Trammell, Mary Jaq. "Multi-Media Sandbox." Birmingham Magazine, May 1987, pp. 39-41.
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ALBUQUERQUE PUBLIC SCHOOLS COMPUTER EDUCATION PROGRAM

Teachers as Trainers, Centralized Decentralization, A Cooperative University: Recipe For Success

INTRODUCTION

Albuquerque Public Schools (APS) is one of the largest urban school districts in the US, with over 77,000 students and 4,500 teachers. In the next three years, another 15,000 students are anticipated to enroll. While all major socioeconomic groups are represented, there is an almost equal representation of Hispanic and Anglo students.

Albuquerque has been using computers in its instructional program since the early 1970's when the district started using a mainframe computer for instruction in programming languages and for Chapter 1 remedial applications. Computer science classes were added to the math curricula in all of the ten high schools, and a pilot program was begun in the APS middle schools.

Nine microcomputers were purchased with federal funds for use in middle schools in the early 1980's. Forty teachers volunteered to attend a on- day workshop offering computer awareness experiences for their students. Fueled by this interest, by strong pressure from a community where over one-third of the parents are employed as technology professionals, and by powerful local economic forces such as Sandia and Los Alamos Laboratories, the district searched for funding sources to expand technology in grades K-12. Their search strategy involved a strong commitment to planning which continues today and has succeeded in transcending a turnover in superintendents and school boards.

In 1983, after a year-long effort by the district's computer education and facilities planning committees to mobilize parent, teacher, and business support, Albuquerque citizens passed a capital equipment bond issue which included 5 million dollars to provide access to computer education for all students in the district. The focus was to be on microcomputers.

The introduction of microcomputers signaled the onset of district-wide training and implementation efforts to bring about the use of computers across the curriculum. Beginning in the spring of 1984, in accordance with an approved three-year plan, the Computer Education Program was piloted in fifteen regular education, three special education, nine occupational education, and nine Chapter 1 sites. Large scale implementation of the program occurred in the 1984-85 academic year. Today, there are 3600 computers placed throughout the schools of the district. The ratio of computers to students in Albuquerque is currently 1:22. About 100 new computers are part of the 1987-88 budget.

Successful implementation has required that the district develop and provide a large-scale training program for staff. The primary vehicle for teacher training has been APS's Computer Education Resource Team (CERT). By the summer of 1987, 75% of the 6000 teachers in Albuquerque had been trained to use microcomputers via an intensive, 64 hour, voluntary training program.

KEY ACTORS AND EVENTS

The Community

In preparing for the bond issue, APS fostered community involvement through regular meetings with parents and the business sector.

Two committees were established by APS that greatly influenced the bond issue and efforts to gain public support: The Committee on Facilities and the Computer Committee. Politically astute leadership on the Computer Committee succeeded in getting that committee merged with the Committee on Facilities. The result was a proposal for a bond issue that earmarked money for facilities and which included $5 million specifically allocated for computers. Even before the bond proposal was made public, APS began other efforts to garner support.

Numerous parent-run groups were formed, many of which actively lobbied other citizens in support of the bond issue. The extent of community support for technology in Albuquerque is not surprising since 25% of APS parents have computers in their homes, and a substantial proportion of the work force is employed by technology-oriented firms like Sandia Laboratories. Community pressure on APS supporting the use of technology in the schools continued even after the passage of the bond issue. APS continues to foster community support with computer training for parents and an equity-oriented outreach program making computers more available to parents.

Efforts to gain the support of the university and business communities for APS's program to infuse technology into the schools included several strategies. One was the formation of the Educational Leadership Council representing key university and business leaders who meet regularly to discuss educational policy (including the role of technology). This Council is also active in keeping political officials, especially the state legislature, appraised of educational needs and issues. The Council's efforts to gain support for educational technology are made easier because of New Mexico's economic commitment to technology. Statewide, New Mexico leads the nation in the number of computers per capita. Sandia and Los Alamos Laboratories serve as role models, and lobbyists, for technological innovation.

The Special Assistant for Educational Computing

After the passage of the bond issue, APS established mechanisms to implement the computing program. At the request of the Board, a staff position, Special Assistant for Educational Computing, was created to assure effective implementation of the program.

The Special Assistant for Educational Computing serves in a pivotal role between the superintendent, area superintendents, principals and CERT, the training staff of the Computer Education Program. Dr. Paul Resta, a Professor of Education at the University of New Mexico (UNM), has served in this capacity since the position was established.

The role of The Special Assistant for Educational Computing is more complex than organizational charts might lead us to believe. As originally conceived by Superintendent Frank Sanchez and UNM leadership during Mr. Sanchez' last year as superintendent, the Special Assistant's role was to coordinate a joint effort by APS and UNM to develop a "cadre of educator technologists." Through a number of unusual budgetary arrangements, Resta, although a full-time employee of the University of New Mexico, is assigned half-time to the Albuquerque School System to serve as the Special

Assistant. Sanchez's successor and current superintendent, Lilian Barna, has been fully supportive of the dual role of the Special Assistant. The Special Assistant, reporting through the Superintendent, regularly informs the school board of the district's efforts at integrating technology into the curriculum. He also works with university and business community leadership to solicit their input and support. And although he serves in a staff role in APS, he is extremely influential and effective in coordinating the decentralized management of the Computer Education Program.

An Active Central Office

Though computer education has been greatly assisted by the active support for technology throughout Albuquerque, the strong support demonstrated by Superintendent Barna for the technology training program has been a significant factor in the success of Albuquerque's program. Her interest in staff development is an overriding element in her commitment to integration of technology throughout the curriculum as a tool.

The Superintendent has made several changes in her administrative structure to assure that computer-related competencies are incorporated into the district curriculum and that the instructional importance of technology is clearly recognized. In early 1987, she added the Director of Management Services to her cabinet to signal her commitment to technology to her administrative team. She has encouraged training in technologies for administrators, viewing them as crucial in the total staff development process.

Most area superintendents, building level principals and teachers support the use of technologies in education, especially those who view their own technology training positively. In fact, some APS principals often reinforce CERT training at the building level through the allocation of building level funds to support a Computer Key Teacher with released time and extra pay.

Higher Education

The local university, University of New Mexico, is a strong force both for training district educators in cooperation with APS and as a statewide lobbyist for educational technology. The Dean of the College of Education is very supportive of the program in word and action. He was instrumental in establishing the joint organizational role of the Special Assistant, as well as initiating a college policy of hiring new COE faculty with technology expertise integrated into their specialty area rather than building a Department of Educational Technology. He believes this will further signal a commitment to the integration of technology throughout the curriculum and minimize "turf" issues. On a statewide level, he actively lobbies state legislators and business leaders on behalf of educational technology as a tool and influenced the drafting of the "Supercollider Bill" which includes monetary support for training in technology.

The Dean also is active in a wide variety of cooperative efforts with APS that go beyond educational computing. Superintendent Barna, building on the experience in the area of computer education, has delegated responsibility to her deputy superintendent to work closely with the Dean of the College of Education to develop a working relationship with the UNM to cooperatively address the full range of training issues facing APS, thus combining the field strengths of APS with the research strengths of UNM.

UNM's Division of Continuing Education has played a central role in delivering the College of Education's training in educational computing, and in providing the APS Computing For Teachers course described below.

The Director of Credit Programs, through Continuing Education, has been involved with the APS technology effort as a member of the Educational Leadership Council and through regular meetings with CERT and College of Education academic departments.

A second higher education training institution in Albuquerque, the Technical-Vocational Institute (T-VI), recognized as one of the most successful technical-vocational schools in the nation, has been expanded recently into a full community college. T-VI provides the district credit Computing For Teachers course offered by APS.

TRAINING

Purposes

Albuquerque Public Schools has adopted a set of mission statements for the use of technology in education and has approved long-range plans to implement these goals:

1. Integration. Computers should be used as a vehicle for instruction, to be integrated into all content areas of instruction rather than as the object of instruction.

2. Computer as a tool for learning and teaching. The computer should not be an end in itself.

3. Independence, collaboration and cooperation: a continuum. the computer should be used to meet individual learning needs *and* to foster collaboration and cooperation between and among students and teachers.

4. Computers and related technologies in society and schools are dynamic and changing. As technology continues to change and grow and impact us, the use of computers and related technologies must remain focused and deliberate... yet open to cautious, well-planned advancements and improvements.[1]

Training Alternatives

Using a 64 hour training course, Computing For Teachers, which was developed cooperatively with the University of New Mexico, APS provides its teachers with two formal teacher training options. Both options use: APS approved instructors, usually CERT members and other teachers from the district; an identical curriculum; and common training sites. One option provides instruction bearing UNM credit. Teachers must pay for this option. The second option is free enrollment in the same course through the Technical Vocational Institute. This option carries no university credit but does count for system training credit. The district pays TV-I $5 per trainee for registration costs. T-VI pays the APS instructors for providing the computer education training courses to APS staff. Through this arrangement, T-VI has been able to build their overall credit-hour production while enabling APS to provide needed training without cost to the district.

District administrators are also encouraged to participate in these training programs. Special required training has also been provided administrators by the CERT team. Clerical staff receive training on an "ad hoc" request basis.

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[1] "APS Educational Technology Plan: The Next Years," unpublished, 1987.

Focus of Training

In its 64 hour Computing for Teachers course, APS training focuses on mastery of three core applications: 1) word processing, 2) database management and 3) LOGO. Additionally, integrating the use of technologies into the K-12 regular, occupational and special education curricula has become increasingly important. This coincides with a district wide emphasis on "using the computer as an instructional tool."

Since 1986-87, workshops have been offered to teach more advanced applications and specific strategies for integrating computers into the content areas. New initiatives in training include cooperative, group-oriented uses and a literacy project using different software.

Other training occurs in the district on a regular basis, including sporadic vendor sponsored training on specific equipment for the occupational teachers and Chapter 1.

Training Management

Ongoing program development and direction for training is provided by a Computer Education Management Team (CEMT). CEMT consists of central office representation from all instructional program areas as well as data processing, evaluation and purchasing divisions. It is chaired by the Special Assistant for Educational Computing. This group considers broad policy questions relating to technology. In early 1987, CEMT recommended, and the school board approved, a new policy requiring that all new teachers be trained in technology prior to joining the district or that they take the district Computing For Teachers course within the first two years of employment.

The Trainers

Two types of district trainers are used predominantly: the CERT team and building level key teachers.

The **Computer Education Resource Team** (CERT), composed of 16 teachers from both special and regular education, was formed to consolidate instructional support and technical assistance to schools using computers. CERT teachers conduct (along with other teachers) the Computing For Teachers training; visit assigned schools on a regular basis; conduct building level workshops for staff; train Key Teachers and parent-teacher groups; and tailor learning materials to the unique needs of students. Members of the team emphatically describe themselves as teachers first and computer technologists second.

Training is also provided at the building level by **Key Teachers** who offer more informal staff development and work in conjunction with assigned CERT members. Key Teachers are responsible for scheduling and overseeing the use of computers, assisting colleagues with software and hardware, keeping school staff appraised of current APS activities, and serving as a communications link to the central office.

Finally, **UNM faculty** offer more advanced training on campus in four programs. In an interesting departure from what is usually found in post-secondary institutions, UNM uses university faculty, APS staff, teachers and administrators as instructors.

IMPACTS AND FUTURES

Reasons For Success

The CERT team, APS administration, and teachers who have been trained generally agree that the training in Albuquerque has been successful. Success has been attributed to the following:

1 Efforts are first made to **make teachers (and students) comfortable** with using and learning about technologies, to ensure that teachers can overcome the risks they often associate with learning about technology. Some risks, initially reported by teachers, include the fear that they will fail to learn technologies (especially when they believe a prior interest in programming or math is required); that their students will out-perform them; or that they will have to specialize in technology at the expense of their curricular expertise.

2. Everyone is initially offered the same basic experience consisting of **computer literacy and training in a limited number of applications**.[2]

3. Training emphasizes the **integration of technology** into all aspects of the curricula. In current training sessions, all faculty are required to produce a product which integrates the use of the computer into their subject area.

4. The district **models the use of technology** by having the CERT team, Key Teachers and district staff *use* technology. Pilot projects are part of the modeling effort. Widespread participation in technology implementation is practiced. The CERT team uses technology as an integrated tool in its training. The Superintendent uses technology in her presentations to the school board. APS and the teachers' union call attention to its models and its modeling efforts.

5. **Informal training is decentralized**. CERT team members, as well as district administrators, found that informal training was facilitated by allowing different training models to evolve within each building rather than promoting a standard model across schools.

6. **Networking among schools is encouraged** since it is seen as important to the success of the program. Networking is enhanced by several activities: during the 1986-87 school year, visits by the new director of the computer education program to every school, including a meeting with the principal, classified staff, and many teachers; publication of a district newsletter on a regular basis; frequent group meetings of Key Teachers and the CERT Team.

7. **Word processing is stressed** since APS has found it to be one of the applications which most facilitates the use of technology throughout the curriculum in Albuquerque.[3]

8. The role of the **personality of the trainer** in technology has been identified as a key element in the success of training. Certain personalities are seen as particularly motivating and these are being increasingly encouraged at the CERT and Key Teacher levels. Some of the attributes of these "successful trainer personalities" have been identified: advocating a non-technical approach; demonstrating supportive, empathetic

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[2] In the early 1980's, training in programming was emphasized. With the advent of applications software, staff training in programming virtually has ended.

[3] Consequently, the demand for additional printers has radically increased.

attitudes; working effectively with adults and people of diverse backgrounds. Technical expertise is not seen as essential for an effective trainer. An ability to use technology as a tool in education, and to share one's insights into ways in which technology enhances teaching, are seen as vital for computer education program staff.

9. According to the Special Assistant for Educational Computing, the strength of the APS program relies on the a **complementary and multidisciplinary efforts** of the APS teachers, principals, CERT, central administration, Board, and the faculty and administration of two institutions of higher education - UNM and T-VI. It is not the result of any single individual's efforts or vision.

Teachers And Students

The following impacts were reported by teachers and staff to have resulted from APS's efforts in introducing educational technologies into the schools:

• Additional training is desired. Since over 75% of the teaching staff has been through the Computers for Educators sequence, additional formal and informal training in computer education is now seen as essential. Consequently, a new three-year training plan has been developed, training has been made a requirement for all new teachers hired; and the CERT team, originally scheduled to return to classroom instruction after the initial wave of training was complete, has been continued indefinitely.

• Teachers report that the emphasis on integrating technology into the curriculum frees them to focus on teaching their subject matter more effectively; helps them avoid having to feel they need to be specialists in technology; and gives them the freedom to learn to use the technology to further their teaching objectives. Several teachers said this emphasis on integrating the technology as a tool, rather that teaching technology as a specialty skill, empowers them to be better teachers, and their students to be more effective learners, in the curricular area for which they are responsible.

• A significant change noted by teachers at the secondary level is that the use of computers has increased their ability to instruct using small group and cooperative learning strategies.

• Teachers and administrators cite significant improvements in student self-concept are the result of the use of technology.

The Organization and Beyond

Several impacts on the organization have also been reported:

• There has been very little attrition of the CERT team members. This seems to be partially due to the evolution of their role from trainer to supporter and facilitator.

• The local teachers' organization, the AFT strongly supports technology training because it views technology as being cost-effective, and because it allows teachers to have more time available for instruction. The AFT also believes training in the educational uses of technology enhances the job holding power of its members, particularly secondary school teachers who are teaching electives with declining enrollments and those who must respond to recent state curricular reforms.

• Electronic mail is seen as a great resource by the CERT team. They report it is being used increasingly by other APS employees as an informal training tool district-wide. It is also recognized as facilitating sharing across schools.

• While loan programs have been available to teachers at the discretion of each principal (and primarily during the summer), parents have just recently had opportunities to borrow APS microcomputers. To make computers more accessible to low-income families, APS Chapter I has a "Parent Loaner" program in which parents, after receiving training with their child, can check out a microcomputer for use in the home for several weeks. Parental and community response to these loans has been extremely positive.

• Staff in the Computer Education Program feel it is important to know what is happening on the national scene in order to plan for change as systematically as possible. They do this through professional contacts, attendance at conferences and meetings, and by participating in regional and national cooperative efforts.

POLICY ISSUES

Several policy issues emerged from the review of the Albuquerque Computer Education Program.

Training

• The district has a new policy in effect this year that all new teachers hired will be expected to have computer competency to support the instructional use of computers. This can be demonstrated via prior courses, proficiency testing or taking the Computing for Teachers course within the first two years of their employment.

• The characteristics of a good trainer, especially at the building level, are still being examined. One CERT team recommendation involved not using teachers to train teachers from the same school for formal training. Two reasons were cited: first, school staff often bring a less serious and more social attitude to training sessions if the trainer is someone they work with daily; second, there is much to be gained by sharing training with personnel from across the district.

• Training must be supported by administrators, especially building level principals, in order for a training program to be effective.

• As teachers become initiated into technology and see its integral value as a tool, many prefer to have abundant opportunities to explore and experiment with the equipment independently and at their own leisure. The preferred location for this exploration is "at home." Loaner programs for both teachers and parents are highly recommended and need to be further explored.

• The CERT members recommended using more variety in the training of secondary teachers to encourage their initial forays into technology applications. Elementary staff were reported to respond in more open ways.

• Trainers discovered that it was better to mix principals with teachers during training. Not all principals liked this method due to a fear of making mistakes in front of their staff.

• CERT team members also noted that it was better to offer training away from a principal's home campus because many principals were apt to be called away the midst of training due to "emergencies." A neutral location kept principals involved in the training program.

- APS staff believed additional strategies were necessary to encourage teachers to use labs for follow-up applications, extra practice, etc.

Equity

- Teachers who had easy building level access to hardware and software, especially those who had computers in their rooms and/or at home, were more likely to implement what they learned in the computer training sessions.

- According to teacher interviews, the major incentive for attending teacher training was to be eligible to have building-level access to microcomputers and easy to use software applications. This was particularly true for those teachers who had access to computers at home.[4]

- Access to computer equipment was consistently cited as one of the biggest concerns for teachers. A frequent problem is that once training has occurred teachers want to use hardware and software at their home schools. They become very frustrated when this is not possible *directly* in their classroom.

- While APS has one of the better computer-to-student ratios in the US, they have not solved the inequity of access between large schools and small schools. Initially, computers were allocated equally to schools, regardless of the enrollment in a school. One way APS is attempting to cope with distribution is to explore alternative placements of equipment ranging from the traditional computer lab (usually 15 computers) in every school to various configurations of mini-labs and/or local area networks (LANs).

- APS administrators and teachers alike hastened to add that the access issue must also be considered in terms of competing technology programs, such as the Young Astronauts Program, and the subtle pressure exerted on teachers by having an increasing number of students with home access to computers and greater computing knowledge.

Funding

- Diverse and creative financial support is seen as crucial to the continued evolution of the computer education program, especially in light of the pressures generated by the 20% growth projection for APS over the next three years. District administrators advise that bond issues cannot be undertaken too regularly without alienating the public. When they are used, it is well worth the time and resources to spend at least a year preparing the business community, the general public, the parents, and the teachers for the bond issue. APS is now trying to shift from bond to internal funding for purchasing hardware. To date, there has been little dependence on grants from major vendors. This pattern is anticipated to continue. The CERT team has an adequate budget for software purchases to support the district program. In addition, schools may use their instructional supply and textbook funds to acquire special software to meet their needs. PTAs have also generated software funds in many schools.

Of a related nature, costs have been cut as much as possible regarding technology related staffing. The size of training staff presently appears to be very lean.

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[4] The district policy is that teachers are required to have a course certificate (or proficiency equivalent) in order to use computer labs.

- APS has not paid teachers stipends as an incentive for training. This has, apparently, not been a serious impediment. Teachers expressed appreciation for being given a choice of receiving free, district-credit training through TV-I, or paying personally for university credit training from UNM. Though the spirit of volunteerism is presently high, administrators must continue to look for ways to recognize teacher accomplishments as proof of the district's commitment.

- APS has developed a centralized purchasing model which has been adopted by the State Department of Education. The district has adopted the Apple and MS-DOS standards for the instructional program, dependent upon unique needs, special requirements and availability of software for each instructional program area. Nevertheless, exceptions to the central policy are allowed, albeit with some difficulty, to encourage genuine decentralized support of the technology efforts.

- APS does not expend significant time or resources in a software review process since software purchases emphasize applications. For other software, the process involves first requesting free examination copies for review. Group pricing is required in order to reach the "district approved list," but single copies can be adopted by teachers or at the building level without district approval. This seldom occurs.

Planning

- Coordination and long-term planning has been a key component of the computer education program since the year prior to the bond issue. This program has been effective, in part, because it has addressed the needs of a very large proportion of teachers and administrators. Even more importantly, it has succeeded because change has not been forced quickly. To quote Superintendent Barna:

> If you want change to occur, go slowly...One year before initiating massive infusion of technology, tell the staff that software and hardware are coming and set up problem solving situations where people can buy into the new changes. This becomes a self assessment process at individual, building, and district levels. After identifying the "when, who and how" it will be resolved with a district plan, run it by *everyone.*
>
> Start with several pilots which are extensively evaluated and then enter full-scale implementation. Put equipment out in phases and require building level plans too. Have a definite strategy of how the money will be spent over the short term and focus heavily on training early on.

Mandates and Reforms

- Due to a recent state reform package (i.e., Senate Bill 106), several mandates have been imposed, including the increase in required units, which impacts elective programs. One of the areas hardest hit is occupational education. An area historically known for its investment in technology, the occupational education program is anticipating ways to counteract the expected drop in student enrollments. A central question arises: how can new forays in educational technologies be maintained, which have significant implications for the work place, despite the decreasing number of electives available to students under the new state guidelines?

- The state legislature has not fully funded the reforms it has passed. Contrary to actions of most other states, the state has "adjusted" its stance on implementation and has delayed requiring implementation of most of the reforms due to limited funds. Until the legislature meets in the fall of 1987, districts are not sure what the implications are.

Maintenance

- Timely and inexpensive local equipment maintenance should be seen as an essential supplement to training. When equipment breaks down, a quick turnaround is necessary to maintain technology as an integrated and hopefully increasingly invisible tool. APS employs two full-time Apple and IBM certified technicians, with a third technician providing services on loan from the District Library Instructional Technology Services Department. APS has three mobile units available to provide on-site maintenance and an extensive lab for more complex repairs. A system has been established to track the number of incidents of computer breakdowns, types of repairs and associated maintenance costs. The Maintenance Department is linked directly to the Apple factory via computer/phone network in order to assure instant technical assistance.

Integrating Technologies Into The Curriculum

APS has set two key directions for the future: making what they have work; and integration of technology into the content areas.

Integration has been an explicit purpose for several years. One strategy which was found to be especially effective, and which APS would recommend to other districts, is to focus on a few applications rather than overwhelming the staff with a myriad of software or trying to teach a limited number of teachers programming. Some integration oriented pilot training programs undertaken recently by CERT include: Computers in Literacy Development Project; Curriculum Review for Computer Integration; Math/Science pilots; and the Integrated Systems Pilot (Wasatch).

Another strategy which seems to promote integration lies in the nature of the CERT team: each member is expected to service both regular and special educators, as well as administrators and classified staff. APS's well known side-by-side structure of integrating special education and chapter one populations is another method which bears further investigation.

Another issue which influences curricula integration involves whether to use school-wide labs, mini-labs, or classroom specific placements. While trained teachers prefer classroom placements, the district's early emphasis was on labs due to limited fiscal resources. Currently the district is facing the loss of computer labs due to space limitations because of the student population explosion. Elementary schools are moving toward mini-labs as a stopgap measure. The pressure from parents and teachers is forcing examination of other alternatives. The three-year plan for 1987-89 recognizes this dilemma and is beginning to research the following hardware configurations: mini-labs (stationary, rotating, and content area), and networking/LAN instruction.

APS is developing a plan of how to integrate other technologies with the curriculum but it was not yet complete at the time of our site visit. Interviews with the Computer Program staff reveal that other technologies are being piloted. Some current exploratory forays into the "other world" included: robotics; CD-ROM; laser art; interactive videodiscs; computers in music and art; and wide area networking.

Evaluation

APS has been frustrated by efforts to evaluate a program that is constantly changing. The school board and others, understandably since they are often product-oriented, seek evidence of success at the pilot stage, before the program has been fully developed or implemented. They want to know that the expenditure of funds is bringing results. In Albuquerque, the evaluation design was developed by a team of APS and UNM staff and concentrated on student, teacher and administrator attitudes; student knowledge and achievement; the effects of computers on classroom climate; motivation and problem solving ability; teacher instructional approaches; and a description of the program as it evolved. APS staff felt this type of long-range research met neither the board's desires, nor the staff's need for immediate feedback which could be used to improve the program. In order to make program evaluation even stronger in the future, APS recommends developing a clear method of negotiating major questions with a design team representative of different constituencies, focusing on a balance of practical and research questions, and concentrating on process information to improve the program as it is being implemented until the program is stable enough that data can be collected to substantiate the effects of computers on student achievement (3-5 years).

CONCLUSION

The future of educational technology appears solid for APS given its strengths in long-term planning; narrow focus on training to use a limited number of applications; emphasis on K-12 integration of technology as tools throughout the curriculum; support oriented trainers who are also teachers; and a comprehensively installed base of computers. APS has succeeded in implementing a large-scale computer education program designed to provide all of the district's students with some access to computers as tools for learning and in successfully training most of its teachers to use computers as tools across the curriculum. Yet there are some issues remaining to be addressed, especially how to cope with a burgeoning growth rate adding over 15,000 students to the system in the next three years.

FOR ADDITIONAL INFORMATION

The principle contact for the project is:

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The principle written materials on the project include:

Johns, J. et. al. APS Computer Education Pilot Project: Computer Effects on Instruction, Evaluation Reports #1-3. Albuquerque: Albuquerque Public Schools, January 1986.

Johns, J. et al. Computer Education Pilot Project Summary 1983-86. Albuquerque: Albuquerque Public Schools, May 1987.

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HOUSTON INDEPENDENT SCHOOL DISTRICT'S DEPARTMENT OF TECHNOLOGY
In The Midst of Challenge and Change

Introduction

Houston Independent School District is one of the largest urban school districts in the country with 190,000 students and 11,000 teachers. There are about 370 principals and assistant principals. One hundred fourteen (69%) of the 165 elementary schools qualify for Chapter 1 services. Over 80% of the students of HISD are minorities (many of whom are from lower income homes). Student mobility approaches 40% each year. Almost one out of every five students display limited English proficiency and over 70 languages are represented among the student population.

In 1982, a highly supportive Houston Independent School District (HISD) approved the establishment of the first Department of Technology (DOT) in a public school system in the United States. DOT started with a staff of three. Patricia Sturdivant, an experienced teacher and trainer who coordinated computing services for a regional education service center serving 54 school districts, was selected by Superintendent Billy Reagan to head the Department of Technology and was appointed the first Deputy Superintendent of Technology in the United States. HISD attracted considerable attention by this action.

A large number of goals were established for the DOT including: coordinating the district's use of technology for instruction and administration; developing a K-12 computer science/literacy curriculum; performing needs assessments and long range planning; maintaining an awareness of new technological developments; evaluating software and promoting its effective use; training administrators, teachers and parents in the uses of computers and other media as tools.

One of the first activities of Pat Sturdivant and the DOT staff was to implement a training program for HISD. Aimed at developing a cadre of Teacher Technologists, the training program that resulted was an intensive 296-hour effort beginning with literacy, progressing to mastery of numerous applications, and concluding with 90 hours of instruction in three programming languages: LOGO, Pascal, and Basic.[1] Many of these trained technologists were later hired by DOT, other school districts, and by business and industry.

At the same time that the training program was being undertaken, DOT began to negotiate with hardware and software vendors and signed a cost-effective contract with Apple.[2] DOT also established district-wide structures including: a centralized system for purchasing hardware and software for all schools in the system; an elaborate software review process; and formalized policies on the use of educational technologies at the building level.

During its first three years, 1982-85, DOT established as a top priority the installation of a computer resource center in each school (not in each classroom). In pursuing this goal, DOT has overseen a large increase in the number of computers in HISD. At DOT's inception there were 280 microcomputers. In 1987 there were 10,000 instructional micros, 8000 of which were Apples. The computers to students ratio is 1:19. There are seven schools with networks, ten mini-computers, an IBM mainframe, 243 schools tied to

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[1] Teacher Technologists study any two of these languages.

[2] Apple's second such contract. The first was Minnesota.

ENET (an electronic mail network), and Instructional Television is being used to disseminate information to teachers and administrators.

Out of the district's total of 165 elementary schools, 114 have Chapter 1 computer laboratories, as well as locally funded laboratories. All schools have computers. Some 40,000 elementary students are currently using Apple IIe's for word processing. At the middle school, all seventh grade students must demonstrate computer competency as required by state law. State mandated computer literacy courses are taught in laboratory settings by the Teacher Technologists and by teachers trained by DOT through shorter training programs. All of the district's 67 middle and high schools have computers, often in labs containing approximately 10-15 micro-computers.

Throughout its existence, the Department of Technology has attracted considerable attention. The Department and its Director have been the subject of at least two "cover" articles in national magazines. DOT has received a steady stream of visitors from school districts, state and national public policy makers, and a broad spectrum of national business leadership. DOT's purchasing and software review policies have shaped the approaches of numerous school districts nationally. In 1985 alone, DOT was cited by the Texas Computer Education Association as having the most outstanding teacher training program in the state; EPIE Institute identified Houston as having the best school-home partnerships in educational computing; and DOT was cited by Electronic Learning as one of the "eight model schools in educational computing."

Over time the Department of Technology became a large centralized organization with great control over all aspects of training, purchasing, research and development, community outreach, and policy making with regard to technology. Recently, a number of factors have arisen placing increased pressure on the centralized approach of Houston: the maturing of the program in Houston; a new superintendent; increasingly active principals and teachers; changes in DOT's place in the HISD administrative structure; and reduced central funding.

TRAINING

Objectives of Training

DOT has identified eight general objectives for its training program:

1. Train a "cadre of teacher technologists" with 296 hours of instruction.

2. Use the teacher technologists to: train faculty; operate computer labs within each building; help teachers use computers in their classrooms; and use technology to assist the campus administrators.

3. Use technology (training videotapes and disk-based tutorials) to teach technology.

4. Present model training sessions and materials where the teacher is a "facilitator" of instruction rather than a "lecturer."

5. Develop a competency-based training program in which advanced training hinges on demonstrated proficiency.

6. Emphasize the use of the computer as a problem-solving and information management tool and de-emphasize programming proficiency.

7. Establish a model school of the future where teachers can practice what they have learned in training.[3]

8. Train teachers in the use of DOT Writer, developed by the DOT, to establish consistent and communicable formats for word processing and data management.

Types of Training

DOT offers three types of training organized into competency based three-hour modules:

- Computer literacy and computer science courses teaching how computers work. These courses meet detailed Texas Education Agency guidelines;

- Courses focusing on how hardware and software can enhance a teacher's or an administrator's personal productivity;

- Training illustrating how technology can enhance and enrich the curriculum.

Training Teacher Technologists

The major focus of DOT's training has been the training of Teacher Technologists.

DOT would like for each school to have one Teacher Technologist, but a principal must designate one of his or her staff for this added duty and must nominate the candidate to DOT for training. By the summer of 1987, 223 out of 248 schools (90%) had requested a Teacher Technologist and 176 (71%) had one.

The teachers who are accepted by DOT for training participate in a 296-hour course conducted by DOT staff after school hours. The course has ten modules: computer operations; literacy and its curricular considerations; 3 programming languages (Basic, Pascal, and LOGO); technology resources and related software evaluations; emerging technologies; scheduling and classroom organization and management; word processing; data management; instructional applications; and self study.

Teacher Technologists are also required to receive 30 hours of update training each year.

Upon successful completion of the program, the individual is designated a "Teacher Technologist" in his or her respective school. Teacher Technologists must teach regular classes at least 60% of their time, but most teach at least 80% of their time. Other duties of Teacher Technologists include:

- managing computer related programs within the building;
- conducting formal and informal training for faculty in after school workshops and meetings;
- training building-level certificated and classified staff;
- offering informal technical support to students, parents, teachers and staff as requested by the building principal;
- establishing computer clubs and other student involvement activities;
- performing a variety of support duties associated with technology such as planning, maintenance, software evaluation.

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[3] Currently DOT is using the Apple Classroom of Tomorrow (ACOT) program at the Black Middle School to pilot ways in which teachers can go beyond computer literacy and address the integration of computers into the curriculum.

Teacher Technologists receive an annual salary bonus of $2000 as long as they complete the annual update course and their assigned duties at the campus level.[4]

The eleventh cycle of the Teacher Technologist training program was completed in the summer of 1987. Since 1984, the training program has produced over 240 trained Teacher Technologists. Approximately two-thirds of those entering the program complete it. Of the 240 Teacher Technologists trained by HISD, a significant number have been lost to the private sector. Recently this "brain drain" has abated. This may be a result, in part, of Houston's poor economy at present. It may also result from the salary incentive offered to Teacher Technologists.

Six DOT district-wide trainers provide the Teacher Technologist training and many other training programs for a wide group of clientele.

Other Training Programs

HISD has a 20-hour mandatory training program for **principals and area superintendents**. Five modules are required: computer literacy; planning and decision making; hardware and software selection, evaluation and implementation; emerging technologies; and information sources. Optional modules include: word processing; data management; telecommunications; online databases; and how to generate parent and business/industry support. In addition, periodic inservice training is required of administrators.

DOT offers a special program for **Computer Literacy Teachers** who teach the seventh grade state mandated computer literacy classes.

Science teachers (K-12) are provided with a specialized set of training modules in order to prepare them to use computers as a part of their approach to teaching science.

DOT trainers develop **customized courses** to meet the needs of librarians, aides, and teachers. These courses range from 24 to 296 hours of instruction and are conducted by the DOT staff.

An elective calendar of **inservice workshops,** open to any staff member in the district, is published every three months. Usually, four workshops are offered daily somewhere in the district by the DOT trainers, the Teacher Technologists, or others.

DOT provides eight hours of training to **volunteers** who work in building level computer labs. To date, 950 parents have been trained in the basic operations of the computer.

Since September 1985, HISD has had a special grant from Apple Computer, Inc. funding an Apple Classroom of Tomorrow (ACOT) project at the Black Middle School. A formal training program was designed for the **ACOT project** and was started in January 1986. Forty-three enrolled. The training focused on word processing, database management, and graphics. By April of the same year, there was a gradual shift from group sessions to individualized sessions to meet unique needs. Sixty-five percent of the training sessions occurred during the regular school hours and the rest were conducted before or after school. Since the inception of the special training for the ACOT project, the percentage of instructional staff possessing computer literacy and special applications skills at Black Middle School has risen from 51% to 92%.

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[4] In September 1987, the superintendent proposed that this stipend be abolished for all except Chapter 1 personnel. This proposal was rejected by the school board for the 1987-88 school year.

HISD offers a variety of training programs for **clerical and administrative staff** using the Macintosh which has been designated the computer of choice for building level administrators. Dedicated applications for some administrative functions (e.g., attendance, inventory) are supported for the IBM PC.

Two **parent training** programs are provided by DOT:

- *Computers Can*, a program offered by DOT since shortly after DOT's inception, provides 12 hours of training for parents and their children. After completing this training, students and parents are allowed to check-out hardware and software for a two week period. Ten computers at each Chapter 1 school are used for training and 10 others are available for lending. Originally begun as a 24 school pilot program, *Computers Can* was later established in all Chapter 1 schools. This successful parent involvement program has been replicated in several districts across the United States.

- *CompuBuy* is a program for all parents and staff. Participants may purchase microcomputers at the district's discounted bid price. A *CompuBuy* Software Lending Library is also available which reduces costs for parents and staff. A free one-year membership in HISD's software lending library accompanies any purchase of a computer made through this program.

Finally, **school board** members have been offered 40 hours of training and some board members have participated.

Other Activities of DOT

DOT, from its beginning, has engaged in many activities other than training. To carry out these additional activities, DOT currently has a staff of 65 including technology trainers, software developers, graphic artists, hardware/software specialists, technicians, and interactive video experts. At its peak there were 189 DOT staff including HISD's audiovisual staff. In 1987, the new superintendent reorganized all central office departments and removed instructional television and library services from DOT.

One primary task of DOT since its inception has been the **development and enforcement of guidelines for the placement of computers.** Before schools could receive equipment purchased centrally, they had to develop a Microcomputer Implementation Plan (MIP) and get it approved by DOT. Approved MIP's:

- described the program;

- identified program objectives, the target population expected to use computers, and personnel responsible for implementing the plan;

- specified the hardware, applications, and software to be used;

- identified the training modules to be delivered to the teachers;

- set schedules for all of the above.

After the plan was approved, DOT provided the training necessary to carry out the plan. When a representative number of staff had been trained, DOT ordered and installed the hardware and software.

DOT established certain requirements for approval of a MIP:

- The principal must have 20 hours of training;[5]
- There must be a Teacher Technologist who can train the staff to carry out the program, or key teachers must must be identified for DOT training;
- There must be training for the teachers of the mandated state computer curriculum (middle schools only);
- There must be plans for training all instructors in science in the science curriculum (K-12);
- Any teacher using computers must attend from 24 to 296 hours of DOT instruction (depending on their teaching assignment and use of computers).

DOT staff also carry out a number of other activities:

- DOT staff organize and conduct a **monthly users group** for middle and high school computer literacy teachers.

- DOT has successfully **produced and sold videotapes** to other districts, corporate purchasers and others, on how to develop and implement local technology plans.

- In 1983, DOT staff began to **develop their own software** for the district. This was the result of the limited software available to meet specific instructional needs (e.g., English as a Second Language), the high cost of commercial programs in the large quantities needed, and because of pressure to meet the Texas Educational Assessment of Minimal Skills (TEAMS) mandates. Specifically, the staff was being responsive to the uniquely pressing needs of HISD's large Spanish-speaking student population. Over the course of the past five years, district-specific software development has continued, fueled by increasing concern about the lack of comprehensive courseware solutions, and by opportunities for sale of software to other districts.

- DOT has also extensively **explored other emerging educational technologies**, especially the interactive laser videodisc and more recently CD-ROM and CDI.

- A unique DOT resource is the **Techmobile**, a specially designed mobile van that tours the district to demonstrate the latest hardware and software developments, such as voice digitizers, music synthesizers, laser printers and a robot. The Techmobile responds to school requests with two-week visits.

- DOT oversees the **Apple Classroom of Tomorrow** (ACOT) program at Black Middle School which is equipped with over 200 micros donated by Apple Computer, Inc. Unlike other ACOT sites in which there is one computer (at home and at school) for students and teachers in one or more classes, Black Middle School is equipped with three Apple IIe computer labs with 30 micros each and there are 3-5 IIe micros in each classroom.

- In the summer of 1986, DOT tried an experiment with unused federal funds. A computer-based **program for "at risk" students** was developed. Teachers were provided stipends for special training, given great flexibility in the teaching approaches they could employ, and were treated as independent professionals. Using DOT software to address TEAMS (state mandated) competencies, the program achieved significant

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5. The Director of DOT has a strong belief that all principals need training and sees this requirement as a critical component of HISD's initiative. She says: "While [the principals] need not be proficient in using computers, they must understand the technology's potentials, implementation, obstacles, and administrative policies and priorities."

improvement among students. Funding does not exist, however, to incorporate this successful effort into the regular program, nor even to repeat it. [6]

- Originally DOT had planned and employed an extensive **research** effort through the HISD Research Department. Budgetary limitations and administrative changes reduced DOT's ability to engage in research.

- DOT's annual **Technology Fair** showcases student and staff achievements in the use of technology. The fair generates widespread enthusiasm and publicity. The contest categories have been designed so that all levels of student expertise can be rewarded. Local businesses support the effort by contributing prizes.

- DOT has sought out **business/school partnerships.** Local businesses are encouraged to contribute tutors, not money. Programmers, systems analysts, and hardware engineers help teach students computer science and related technical subjects.

- DOT's **monthly newsletter**, Technogram, alerts staff to training opportunities and communicates information about new technologies.

DOT PRINCIPLES

As a result of these activities of DOT over the years, DOT and its Director, Patricia Sturdivant, believe several principles should be followed in introducing computers into a school system:

- establish policies early;
- standardize hardware and software to enable a district to focus its program, as well as simplify to training and maintenance;
- train administrators first and teachers second;
- use technology to teach technology;
- emphasize practical computer applications.

DOT'S BUDGET

The DOT Director also favors a well-managed and centralized budget process for technology. Such an approach, she feels, allows for more flexibility than decentralized, splintered acquisition of hardware and software.

DOT is a very large and complex organization. Its budget reflects its size. During the 1986-87 school year, the DOT budget totaled $2,291,758 plus $350,000 generated from software development sales. The source of this funding included Chapter 1, Chapter 2, state and local monies. This represented a $545,000 reduction from the prior year.[7]

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[6] Even though this small (teacher to pupil ratio was 1 to 8) pilot program succeeded, DOT staff reported a lowered morale of the members of this project team since the program could not be permanently implemented, even on a limited basis. This is always a risk taken by pilot programs for which permanent funding is difficult to obtain.

[7] In the 1987-88 budget, the Superintendent attempted to further reduce DOT's funding through decentralization and staff freezes. These freezes were rescinded as of September 1, 1987, in part because of strong resistance generated by DOT Director Sturdivant.

DOT'S PLANS FOR FUTURE ACTIVITIES

DOT has several new activities currently in development or planning stages:

- Software is under development which will tutor students who have failed the state-administered criterion referenced tests (grades 7, 9, 11) required for high school graduation.

- Teacher Technologists interviewed indicated they will offer more training classes at the building level because program evaluation data revealed teachers would like more courses conducted there.

- A DOT developed multimedia program (software and video) for "at-risk" middle school students is being piloted in 1987-88 to reduce the number of dropouts.

- The K-2 reading/language arts software program (including a talking word processor) will be expanded from 119 to 143 elementary schools.

- The spinning off of DOT's software development unit as a private enterprise[8] will be explored. The DOT Executive Director has endorsed establishment of a National Center for Learning Technology to accomplish this objective.[9]

IMPACTS

State Mandates and "Reforms"

The state legislature, and its various mandates and "reforms," have negatively affected the training in educational technology that takes place in Houston.

The Texas Educational Assessment of Minimum Skills (TEAMS) has had an especially strong impact on the district. One impact was to encourage DOT to write its own software - to address the the specific mandates of Texas. The emphasis on software development helped bring about an increase in size of the DOT staff thereby affecting DOT's image, and lately its political effectiveness, within the district. The commitment to software development helped to shape the orientation at DOT by focusing efforts on computer-assisted instruction.

Another impact was to deemphasize the use of LOGO, which had been emphasized prior to the passage of TEAMS, since the emphasis on accountability and minimum competencies in basic skills specified by TEAMS made the district's efforts to address higher order thinking skills and affective behaviors difficult.

In 1983, Texas House Bill 246 was passed requiring students to take a computer literacy course during the seventh grade. Middle school students are exposed to computer concepts such as programming, history and development of computers, and the impact of technology on society. Students are also given hands-on experience with word processing and databases. These courses are taught by Teacher Technologists and computer literacy teachers who must pass a state computer literacy test before teaching the course.

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[8] MECC has recently gone through such an evolution. See the case study on Minnesota. Also, see below p. 66.

[9] See Appendix D.

The state mandated 7th grade computer literacy course focuses attention on the "computer course" and the "computer teachers" that teach it. This mandated focus on computers as subject matter, emphasizing programming and the recall of facts about computers, conflicts with HISD's desires to use the computers in an integrated way throughout the curriculum and, also, inhibits the use of computers to integrate the curriculum. In addition, HISD believes the resources expended on the mandated 7th grade computer courses would be better spent in an effort to support the integration of computers into the general curriculum. With limited resources, the computer literacy course has made it difficult to place computers in the classrooms of content area teachers.

Recent state legislation makes computer literacy courses in high schools no longer eligible for state graduation credit. Credit was allowed for a two-year transition period that ended in June 1987. Credit is, however, still available for Computer Science I and II. This has caused a serious disruption to HISD's overall computer program, and ultimately affected staffing and training decisions.

The statewide textbook purchasing plan undermines efforts to integrate the computer across the curriculum. The restrictiveness of the statewide textbook adoption regulations is clearly evident when we consider that the computer textbook recently adopted must be used for *6 years*. In such a rapidly changing field as new technologies, textbooks should probably be replaced every *6 months*, or, better yet, be published as loose-leaf notebooks, or provided on easily changeable electronic media.

Another impact of state legislation involved the requirement that those engaged in training Teacher Technologists have a master's degree. The HISD training relied on staff trained by the district. Although HISD had provided its trainers with a training program about two-thirds the length of a master's program, the state did not consider them qualified to teach other teachers. It took HISD seven months to get a special dispensation from state regulations for their program.

Perhaps the greatest impact of the state mandates and subsequent legislation was in the area of budgets. Full-day kindergartens, specific library requirements, and even changes in local real estate assessment evaluation procedures (not a part of the state educational mandates but included in other state policies adopted about the same time,) placed enormous demands on the HISD budget. Technology was one of the areas hardest hit by the resulting budget cuts and reallocations.

Equity and Access

A large proportion of Houston's computers has been bought with Chapter 1 funds. Because of this, serious questions of equity and access in non-Chapter 1 schools have arisen.

Equity and access also appears to be an issue in another instance. We found that a special education department program for autistic children (not part of DOT) had access to computers only during the summer at the ACOT middle school. Despite great positive impact that the use of computers had on the autistic children, not a single computer was available for use during the regular school year. According to the staff interviewed, many of the gains exhibited at the end of the summer of 1986 had been lost by the following summer.

POLICY ISSUES

Efforts To Decentralize DOT

For the first three years of its operation, during the tenure of Superintendent Billy Reagan, the centralized approach of DOT went unchallenged. In 1986, Billy Reagan resigned as Superintendent of HISD. Dr. Joan Raymond from Yonkers, New York, was selected as his replacement. In the ensuing months the new superintendent has begun to put her stamp on the HISD efforts in technology.

Dr. Raymond sees the present structure of DOT as inconsistent with her strong advocacy for decentralization.[10] One of the first things the new superintendent did was to reorganize the DOT and its staff, change Pat Sturdivant's title from Deputy Superintendent of Technology to Executive Director of DOT, and change Sturdivant's line of reporting from the Superintendent to the Assistant Superintendent of Curriculum.

Dr. Raymond then formed a task force to study DOT. This task force was comprised of district administrators and university professors, but did not include representation from DOT. The task force report concluded that "in order to achieve integration of technology into the curriculum, all teachers will have to be comfortable with information technologies. This is changing the focus of the department's training from training teacher technologists to providing broad-based training on an ongoing basis." The task force went on to suggest that planning for this change should include: centralized coordination of training with instructional needs, geographic distribution of training sites, coordination of training times with district school hours, and use of universities as resources for advanced training.

Dr. Raymond, as part of her changes, also began exploring the possibility of redirecting the use of Chapter 2 funds in the District. On May 18, 1986, an article in the Houston Chronicle reported that the redirection of district Chapter 2 funds could result in the DOT being "abolished" since HISD had allocated little money from local funds for hardware and software.

During the spring of 1986, The Houston Economic Development Council, in an effort to support the DOT, proposed that DOT be "spun off" from the district to become a not-for-profit foundation called the National Center for Learning Technologies. On April 18, the Board of Education authorized HISD administrators to work with HEDC to develop a plan for further action. Houston businessman Alan Rudy began to negotiate with two Houston universities to form a non-profit, tax-exempt consortium with which DOT would be affiliated. It was envisioned that university students would serve internships and professors would have access to the educational programs the Center would develop. HISD would be able to purchase the services of this new foundation, The National Center for Learning Technology, on a cost basis.

In August 1987, Superintendent Raymond proposed to the HISD Board a variation of this arrangement calling for the spinning off of the software development efforts of DOT.[11]

As a result of the new Superintendent's administrative reorganization and emphasis on decentralization, the role of DOT is in transition. As a symbol of a centralized approach to training, hardware and software purchasing, and development, the Department of Technology is currently being subjected to different internal constraints than previously existed; has reduced stature within the administrative hierarchy; and has been forced to direct much of its energy to what DOT sees as a fight for survival.

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[10] This conclusion is based on an interview with the Assistant Superintendent of Curriculum and our observations in Houston. We were unable to interview Superintendent Raymond for this study.

[11] No action had been taken on this recommendation at the time the interviews for this study were conducted.

The results of decentralizing DOT functions to the building level, should that occur, are unclear. There is no evidence that HISD is attempting to develop a **plan** for a decentralized effort to address educational technology; computer training; computer repair; community training; or investigation of new technologies.

Other Issues Raised in HISD

Internal HISD reviews have pointed out several training issues. First, DOT feels there is a need to devise ways to provide training sessions during the regular work hours or incentives for training outside work hours. Second, it is believed there is a need to give the Teacher Technologist some relief from student teaching duties or to increase the number of Teacher Technologists assigned to help other teachers. All levels, from elementary to secondary, are having problems finding time for the Teacher Technologist to work effectively as a trainer, coach and role model with teachers and administrators while teaching a full classload. DOT believes it is critical that the question of funding additional planning and training time for the Teacher Technologist to work with other building level staff be addressed.

Another policy issue that is emerging in HISD concerns the amount and type of training needed for HISD staff. Some key administrators feel self-education should be the primary emphasis given the base of Teacher Technologists at the building level. But this may only be an argument that accompanies an effort to reorganize or reduce the size of DOT.

From a central office perspective, DOT was judged to be not satisfactorily "providing the overall planning and coordination necessary to support other departments in the district." To correct this, the central HISD administration eliminated DOT's administrative autonomy as a separate unit. DOT is now responsible to the Curriculum Department in the Instructional Division. The HISD central administration believes that DOT, as a result of this administrative change, will work more closely with curriculum specialists and program specialists in coordinating services.

Issues And Questions Raised By This Study

Our observations in Houston raise several other policy issues and questions for consideration.

First, we suggest it is appropriate to consider whether a comprehensive training program like that currently in place for Teacher Technologists in HISD is now the type of training that is needed. It appears the original training model, with its emphasis on programming, has not been modified (and shortened) as one might expect given the current move to integrate the use of computers throughout the curriculum.[12]

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[12] A great emphasis is placed on programming (i.e., Basic and Pascal especially) for the Teacher Technologist. This emphasis on programming differs from the attention given in other sites visited for this study. DOT feels this emphasis is appropriate since Pascal is required for the state approved Computer Science I and II courses. Our findings would challenge this view except for those directly responsible for teaching the Pascal classes.

Second, we suggest that a policy which emphasizes the extensive training of a very limited number of HISD staff may be inconsistent with DOT's desires to integrate technology in the classroom and throughout the curriculum. Efforts to integrate technology through the curriculum require that all staff be trained. Currently, HISD is not allocating its training efforts, and does not appear to have adequate resources, to achieve this goal. The primary focus is still on the training of Teacher Technologists. The training of all teachers is much less well developed. Training at the building level has been limited in scope and displays much variance from building-to-building. Our findings from other sites visited for this study indicate that a training course much shorter than that offered Teacher Technologists, a course which eliminates programming as a key element, which contains exercises designed to increase teachers' abilities to use computers across the curricula they teach, and which is directed toward all teachers, may now be more appropriate than the original Teacher Technologist approach.

Houston relies almost entirely on a laboratory computer arrangement. In part, this is the product of low purchasing levels for several years; in part, the result of the state mandated computer course which is taught in a laboratory arrangement. True integration of computers will require a significant increase in the purchase of hardware, especially in non-Chapter 1 classrooms, and the placement of computers in classrooms.

Morale among technology-committed educators appeared lower in Houston than any other project we visited. Although HISD has more resources than many other school districts, HISD does seem to function amid unusually rigid state and local restrictions. For example, state regulations such as TEAMS helped to shape the staffing patterns at DOT by encouraging a growth in software development; focused DOT on computer literacy rather than an integrated use of technology across the curriculum; undermined the district's efforts to address higher order thinking skills and affective behaviors through the use of LOGO; and diverted HISD from its plans and goals. In times of scarce resources, it is not surprising that there are few other incentives, few psychic rewards, that derive from regular experimentation and limited risk-taking to boost moral and to draw one's attention away from budgetary and political issues.

CONCLUSION

The HISD approach to technology training and implementation through DOT is significant because DOT was a pioneer in implementing technology programs on a districtwide scale, several years before other districts undertook such efforts. The magnitude of this accomplishment should not go unnoticed.

FOR ADDITIONAL INFORMATION

The principle contacts for the program are:

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The principle written material relating to the program include:

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A STATEWIDE MODEL OF TEACHER TECHNOLOGY TRAINING: MINNESOTA

Teamwork and Sharing in a Supportive State

INTRODUCTION

The state of Minnesota was selected for inclusion in this study for the number of "firsts" it exhibited in educational technology and because, given such a history of consistent commitment, its state specific teacher training models could likely serve as models for other states.

In 1973, Minnesota became one of the first states to concentrate on technology as a statewide theme for economic development and education. As part of this emphasis on technology, the state created two of the earliest statewide consortia to facilitate the delivery of technology in education: TIES, to share sophisticated mainframe services with local districts; and MECC, the Minnesota Educational Computing Consortium, to provide schools with quality courseware at a time when commercial producers were not ready to risk development funds.

The state legislature has also provided research monies to encourage districts to experiment with new methods of delivering instruction. Through the Council on Quality Education (CQE), the first installation of a low-power, two-way television school network and the first K-12 production and use of videodiscs in the U.S. were made possible.

Minnesota also was the first state to develop a series of models for using educational technology in demonstration sites; was one of the first states to encourage, with state funds, large scale training of teachers to use technologies in education - primarily through regional training centers; is the home of a large number of school districts and businesses that have achieved wide recognition as leading users of technology, including computers, distance learning video, and interactive laser video production; and is the home of the Blue Earth School District, one of the first programs funded by Apple's Classroom of Tomorrow (ACOT) Program.

The Minnesota experience is a rich one. Like any review of this scope, our observations are in no sense complete. But we do feel that the energy, the excitement, the effective training and implementation of technology throughout the primary and secondary systems can be readily observed and understood.

CONTEXT

Our study included a review of:

- The **state department of education** and its department of technology;

- **Local school districts** and regional demonstration projects funded by special demonstration grants from the state;

- **Higher education teacher training institutions**. We focused on the University of Minnesota (UM) although key people at Mankato State University (MSU) were also interviewed. UM is a large cosmopolitan university with 5,000 students in the College of Education which has a clear focus on research. Mankato State training is geared for the practitioner. Mankato has about 1,500 students in the College of Education.

- **regional training programs and consortia**: MECC and TIES;

- **local education agencies.** We paid special attention to four of the 435 school districts in the state. Minneapolis Public Schools, with 39,000 students, is the largest district in the state. Minneapolis has a large, and increasing, percentage of minority students which now approaches 45% of the total student enrollment. Two rural districts were visited: Shakopee Independent School District, with 2500 students and Blue Earth, with 1050 students. Both Shakopee and Blue Earth have highly stable and predominantly homogeneous white populations. We also looked at suburban St. Louis Park with its 4200 students. St. Louis Park, previously predominately white, has had a recent significant increase in Hispanic and Asian students.

KEY ACTORS AND EVENTS

Technology has been extremely important to Minnesota's economic well being since the early 1970's. Forty percent of the state's economy is linked to high technology, most notably 3M, Control Data, Honeywell, Sperry, IBM and Cray Research. Even the banking, medical research, insurance, agribusiness and education have been technologically intensive.

An Active Legislature and State Department of Education

Legislators have publicly acknowledged the importance of educational technology in educational improvement efforts and economic development and responded with the latest biennial budget with $6,300,000 for six statewide initiative:[1]

1. Each district was given the opportunity to receive 75 cents per student or a minimum of $500, whichever was more, to develop a *technology utilization plan.* Ninety-seven percent of the districts applied for funds and submitted satisfactory plans to the state department of education;

2. Districts were provided with a $1 per student for inservice in the area of technology training. District staff determine the specific topics of highest priority to them. To receive these funds, districts need a state-approved technology plan and a brief agenda of training activities. Additional support was also funded in the form of seven regional MECC coordinators to disseminate MECC materials and to help districts learn how to use them. Finally, the Minnesota Department of Education was allocated $220,000 to provide state and regional workshops that had appeal beyond one district. Specifically, this involved special interest workshops, advanced implementation training, and support for professional organizations to provide training to their constituents. Over the two year period, more than 20,000 people participated.

3. To cope with the frustration of deciding about courseware selection, Minnesota developed and publishes the "High Quality Courseware List" every six months. Indicative of the statewide preference for decentralization, this list is not a list of approved or disapproved courseware. Rather it is a list of reviewed and recommended software. Decentralization has its costs, however. Districts may purchase what they wish, but the State will reimburse school districts for 25% of the cost up to $1 per student for

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[1] Of these six initiatives, funds related to integration, courseware and dissemination will be cut in half by FY'89.

materials purchased which are included on the recommended list. The state also pays a small stipend to non-department members of the designated evaluation teams for the reviews of software.

4. Article 8 legislation authorizes the Minnesota Department of Education to purchase rights to duplicate software and/or make volume purchases if the courseware packages "are available to the state at a lower cost than if purchased by school districts individually." The Legislature has appropriated nearly $500,000 over a four-year period for this purpose.

5. The Legislature also gave the Department $500,000 over four years to contract for the design and development of courseware packages which will meet the needs of school districts and which otherwise are unavailable or too expensive for individual districts to develop. Database managers and videodisc courseware have been the primary focus of this program.

6. Funding for twenty technology demonstration sites has been provided and represents a $2.2 million appropriation during the biennium.[2]

Each site was funded for one start-up year and three additional years of operation. The Minnesota Legislature insists that no demonstration program can be funded for more than four years, regardless of its quality. It is felt that in four years there should be widespread adoption of those demonstrations with merit.

Because Minnesota is convinced that "a visit to a site has more initial meaning to teachers than extensive inservice offerings," the Legislature designated $300,000 each biennium for transportation costs incurred by visitors from other Minnesota public schools attending workshops conducted by the demonstration sites.

Private Sector

There is a powerful technology culture which thrives in Minnesota. The first CEO of Control Data Corporation, Frank Norris, was credited by many of those interviewed as strongly influential in the creation of MECC. Numerous other elements of the private sector have strongly supported the state department of education's efforts to be "marketers of technologies" and to provide key leadership and coordination services statewide. Many school districts and higher education institutions have obtained support from private vendors (especially Apple and Corvus) and the federal government.

Higher Education

The dean of UM's College of Education has offered computers to all faculty through a cost sharing between his office and the respective department chairs. He noted that over 90% of the faculty are using computers, at least at the word processing level. The college also has three labs equipped for teachers, one being state of the art. UM staff do not view their role as the major deliverer of teacher training and appear to have little impact on the statewide model of teacher training in educational technology, except for some influence on research and evaluation.

In the summer of 1987, the College of Education joined with MECC in establishing the MECC/University of Minnesota Center for the Study of Educational Technology. The purpose of the Center is to foster joint research on how technology can be most effectively used in schools. The Center is expected to support from five to ten projects during its start-up phase. According to MECC administrators, MECC has been attempting to establish such a cooperative relationship with MU for 14 years. Only recently has a core of energetic UM faculty emerged supportive of the joint effort.

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[2] Refer to Appendix H for descriptions of these projects.

Mankato State University was most frequently mentioned by practitioners as the higher education institution most interested in helping educators implement technology on a daily basis. MSU offers an interdisciplinary Master's of Science degree in Educational Technology. The program emphasizes interactive methods of communication and instruction with coursework in interactive video, low power and cable TV, satellites and microwaves, and computer-assisted instruction.

Educational Consortia: MECC and TIES

Both consortia have traditionally played a significant role in Minnesota.

1) TIES originated during the 1970's, as a statewide timeshare mechanism and has expanded into offering inservice training as well. TIES developed a "trainer of trainers" training model. It consisted of setting up workshops via district computer coordinators who became the support network for the next level of trainers - the building level coordinators. This model was later adopted by MECC and is still used today. There are 53 member school districts in TIES, most of which are suburban. TIES members pay a small membership fee and have access to a strong network of resources, a yearly TIES conference, TIES equipment labs for training, and a comprehensive resource center for software preview. Two TIES staff are supported by state monies to offer training to one of the regions of the state once served by MECC.

2) MECC was started as a statewide consortium which consisted of four stakeholders: University of Minnesota, state colleges, community colleges and the state department of education. Within its first year of existence, MECC had a statewide timeshare system in place and was increasing the coordination of technological services for higher education. In 1978, MECC pioneered the first statewide purchasing agreement for educational micro-computers. This historic agreement represents the first large contract won by the then new Apple Computer Co. With the dearth of educational software available in the late 1970's, MECC evolved into a software developer and was charged by the state department with statewide technology training from 1974-84. As a consortium during this period, MECC employed regional technology coordinators to conduct district level and regional training. During 1984-85, MECC became a self-supporting corporation. This was partially the result of the profit generated by its software development activities. Upon becoming an independent corporation, political pressures forced an opening of the bid process for the regional coordinator service contracts. The following year MECC still received the lion's share of contracts (i.e., six regions), though TIES got one regional contract, and two other contracts went to two other groups. (It is interesting to note that even though some higher education institutions applied, none received state service contracts.) TIES and MECC staff anticipate that the state funding for regional coordinator contracts will terminate within the next year. Interviews with state staff confirm that the state expects local school districts to pick up the costs if they believe technology is important.

TRAINING

State Efforts: TIES And MECC

Since 1973, formal training has been mandated by state legislation and managed by the state Department of Education. The predominant model of statewide training is through the regional coordinators who are responsible for establishing a base of competency in the use of technology for education. In the state department's perception, district inservice works best where there is a strong regional coordinator. MECC and TIES are perceived by school district staff as offering the strongest models. Since the state has been supporting computer training for years, a high percentage of the state's teachers have been exposed to the basics. Current training is increasingly a response to special requests for training in specific applications like Appleworks or in emerging areas such as telecommunications. The timing of training has changed over the course of the years in Minnesota. Teachers and trainers interviewed indicated that intensive summer training and weekends are now acceptable if the training is for credit, but there is considerable opposition to evening training sessions.

Both TIES and MECC offer training and other services to districts outside their regional service contracts on a membership basis. MECC serves over 5000 school districts throughout the United States and Canada. MECC also provides training, sponsored by Apple Computer, Inc. for educators around the U.S. on a wide range of computer topics.

Local Training

Local school districts vary greatly in the nature of teacher training models. Many rural and small schools, which lack a concentrated resource base, tend to contract with consortia or avoid providing training beyond a literacy level. Blue Earth and Shakopee depart from this pattern and have supported extensive staff development through active grant writing and community partnerships. In Blue Earth's case, the principal wrote an Apple Classroom of Tomorrow grant and worked with the local businesses to raise funds for a computer director who would also provide technical assistance to the private sector. In Shakopee, the computer director forged relationships with Corvus, receiving equipment grants, and established Shakopee as a beta test site for several major technology companies. He also worked with the nearby penal institution to write some cooperative grants since specific funds were available for penal training. The largest school district in the state, Minneapolis, views training as one of its priorities and has developed an extensive inservice training program.

Informal training models

Informally, much training is provided at the building level. Additionally, TIES has found informal training strategies particularly productive in reaching a broad spectrum of participants. One strategy, for the past eight years, has been the convening of sharing meetings once a month at the TIES headquarters. Participants includes teachers, administrators, coordinators, and even an Apple representative. Another strategy used by both TIES and MECC includes extravaganza style annual meetings which draw statewide and beyond. Finally, opening resource centers for software reviews has become very popular. TIES facilitates this review process by focusing on one subject per month for a full day. TIES also will go to districts on request to share software.

Purposes of Training

Other than the large school districts with sufficient training staff, the most comprehensive responsibilities for training reside with the regional coordinators. This is especially true of TIES and MECC, given the large and well established resource base upon which they can draw. TIES and MECC are similar in their state mandated aims. Their primary focus is on training for curricula integration using the computer as a tool and specifically addressing usage of state supported software. Software applications range from word processing to telecommunications to desktop publishing.

The major thrust of training at the school district level varies with each district's resources. Those districts, be they rural, urban or suburban, tend to be addressing the same purposes. Once the district has a sufficient base of comfort with technology, as well as hardware and software, *integration* of technology into the curriculum becomes the primary challenge.

UM offers an introductory course, a school and society course, as well as master's and doctoral level courses which appear to be more targeted for those intending to work in business and industry training fields. Although UM is involved in both inservice and limited preservice technology training, delivering teacher training in technologies is not a key focus of this institution. Rather research is its prime agenda. But it should be recognized that they train only 12% of the teachers even though 65% of the pool is in the Minneapolis/St. Paul metropolitan area. Key UM administrators indicated that training for the untapped pool of educators is the role of other training institutions such as MSU or MECC.

Trainers

TIES has two trainers paid by the state department regional coordinators contract. MECC has six. In addition, both organizations offer access to other technology specialists as the need demands.

Recently, the state Department of Education has encouraged the regional coordinators to subcontract with exemplary teachers to provide inservice that is beyond the coordinators curricular expertise. According to key state department administrators, the most requested inservice is now curricula related and no one person could possibly be an expert in all content areas.

Annual meetings held by TIES typically attract 500, participants and MECC annual conferences include students and draw an even larger, national audience.

In addition, the state department reports that one of the most successful (at genuine integration) and least expensive training models which they will continue to encourage is the use of state professional associations to train teachers at their respective annual meetings.

The following characteristics of an effective trainer were consistently cited by trainers and participants as desirable: strong in curriculum first, technically knowledgeable, skillful in reaching adults, comfortable with hands-on strategies, proponent of networking.

Participants in Training

While teachers are the priority, administrators and classified staff are trained by the regional coordinators, as are building and district coordinators and higher education faculty.

IMPACTS AND FUTURES

On the Teaching Staff

- Consistent with several other sites in the study, most interviewees noted how much more quickly elementary teachers were able to grasp and apply technology across the curriculum.

- Both TIES and MECC advocate making training models more "hands-on" and providing additional time for practice. Follow-up sharing sessions are also encouraged and phone consultations are available at more advanced levels.

On the Organizations

The two TIES staff interviewed indicated their informal teacher sharing network was exceptionally well received. Both also noted that learnings gained from these sharing sessions, as well as formal training were being incorporated into an "exemplary practices" database.

The state department staff note that the demonstration sites which were extensively funded have had tremendous dissemination benefits. Over 30,000 people visited the sites. Evaluators reported that actual adoptions by "in-depth" visitors to the technology demonstration sites were 62% in computer management and 74% in a variety of instructional use of computers. Another 15% to 26% of the visitors intend to adopt all or parts of a demonstration program in the near future. The sites developed nearly 200 products that are being transferred to other locations, both in and out of state. Evaluation findings show that adoption of technology was most clearly linked to "the quality of the inservice...specifically designed to meet teachers needs." Apparently, the most significant inservice was perceived to be when individual teachers were allowed to work onsite with master teachers in classroom settings very similar to their own.

One of the biggest disappointments to all major audiences interviewed involved the lack of participation by the universities.

Incentives

Higher education representatives reported that the "whole notion of saving your job" was one of the incentives involved with technology training at lower levels of training. Teachers did not frequently report this.

POLICY ISSUES

Equity

Minnesota is a very homogeneous state in terms of cultures and the issue of ethnic and racial equity only emerged in the larger and more urban districts around the Twin Cities area. Other equity issues were not mentioned.

Training

In Minnesota, the state department of education has a very strong impact on the method, as well as the products of instruction. For example, the new state contract with TIES and MECC requires that regional coordinators bring in exemplary teachers to do presentations. Additionally, the state department of education, with its control of funding and policies regarding teacher training, has been shifting from support of a "trainer of trainers" model to "teachers teaching teachers" model which has been emerging in other sites visited for this report. This model has worked particularly well in Minnesota when practicing public school educators team with university faculty to conduct workshops (e.g., UM faculty working with Minneapolis area teachers to conduct social studies workshops and Blue Earth school staff working with MSU faculty to deal with curricular integration issues).

The state department of education staff said the new "teachers teaching teachers" strategy had proved to be unexpectedly cost-effective and well-received. Consequently, the state department of education is now providing seed monies to encourage state chapters of professional groups (subject matter primarily) to train their colleagues in how to integrate technologies into the curriculum.

The Role Of MECC

As MECC increasingly becomes a bona fide corporation, many educators expressed concern that MECC will become less responsive to district and building level educators.

Centralization

The centralization of services mandated by the legislature for over ten years, and managed by the state department of education, seems to have encouraged an installed base of equipment and software to be distributed across the state. It has also enabled the state to transcend literacy training.

But decentralization is being increasingly mandated by the state legislature. Given the state's push for many centralized and state department managed activities in the past, the question emerges of how the dependency fostered under centralization is going to be overcome in the short-term, especially in rural and small school districts.

Purposes of Technology Instruction and Training

The early and consistent adoption of one vendor (Minnesota is 95% Apple) has had a powerful effect on training and instructional programs. Many feel this has been instrumental in facilitating the transition to curricula integration. Coupling the statewide purchasing phenomenon with technical literacy mandated by state policy in 1985, seemed to be a strong incentive for succeeding in getting all districts to comply within 2 years.

The state department of education, with its control of funding and policies regarding teacher training, has been shifting from support of a "trainer of trainers" model to "teachers teaching teachers."

Certification

The consistent position across all audiences interviewed was that additional requirements were opposed and would inhibit the flexible transfer of technologies to teachers and encourage specialization rather than integration.

TIES is currently faced with problems of legitimizing its nontraditional, modular training with state guidelines for inservice credit-bearing courses.

Other

Plans for the near future include continued exploration of interactive videodisc and CD ROM technologies.

CONCLUSION

Minnesota has accomplished much in training teachers to use technologies and in encouraging the purchase of technologies. State financial assistance, a grant mechanism fostering local experimentation, and an ethic of sharing and cooperation are partial explanations for that success.

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IBM - NATIONAL COMPUTER TRAINING INSTITUTE
A Joint Venture: Too Little; Too Late

INTRODUCTION

In 1984, The National Computer Training Institute (NCTI) of Fremont, California, and IBM entered into an agreement designed to provide computer literacy training for a broadly based sampling of American teacher trainers. Approximately 97 pairs of trainers from 49 states and the District of Columbia were brought to the University of California at Berkeley for two weeks of intensive training. Sponsored by IBM, the training emphasized use of the IBM PC Jr., four components of the IBM Assistant Series of administrative programs (word processing, report writing, database development and management, graphing), Multiplan, Basic, LOGO, telecommunications, and software evaluation.

In return for the commitment to the two weeks training, IBM provided each pair of trainers with 17 IBM PC Juniors, IBM RGB monitors, IBM graphic printers, complete sets of software, modems, carrying cases, and a variety of additional software and peripherals. In return, each site—ordinarily a public school—was to provide a secure, air-conditioned laboratory for 15 sets of equipment and make the laboratory available to teachers for evenings, weekends, and summer training sessions. In addition, each training facility would use the lab for computer-related instruction during the school day during the academic year. This program was selected for investigation because it is one of the earliest examples of the private sector supporting such a comprehensive and expensive effort at computer training for educators.

Changes: How NCTI Got There

The chronological history of the program is instructive. Consider the following evolution of events (and demise of a large-scale program) from May 1984 to September 1985.

May - June 1984. Potential sites and teams are identified. NCTI representatives attempted to identify two "experienced computer users" who were teaching in the school where the lab would be placed. The original goal was to establish 100 teams.

August 1984. Approximately 97 teams of two individuals each are transported to the University of California-Berkeley for two weeks of training by NCTI and IBM staff, and others.

Teams return to their individual schools with their own assigned computers. Software and peripherals are shipped.

September 1984. IBM replaces chiclet-style keyboard with a more traditional keyboard.

October 1984. Initial shipments of 15 systems per site are received in the 97 schools.

First NCTI marketing brochures are mailed nationally, and national ads in education newsletters are purchased.

January 1985. First classes are scheduled.

March 1985. IBM acknowledges a Teledyne report that IBM will not renew Teledyne's contract to produce Juniors after current stock is depleted.

August 2, 1985. Delta airline crash in Dallas claims life of Phil Estridge, high ranking IBM administrator most responsible for the NCTI/IBM initiative.

September 1, 1985. IBM withdraws from the joint venture and NCTI is out of business.

August 1986. IBM formally notifies sites that they may keep hardware and software.

Resources

IBM and NCTI viewed this effort as a major step toward eroding Apple's installed base of microcomputers in the school setting. The planners of the program were aware that a successful program would require both hardware and software applicable to the K-12 setting, and a cadre of teachers/trainers committed to the system and available to provide training. Major commitments in terms of time, hardware and software, and direct funding were made by IBM to the NCTI effort.

TRAINING

Purposes

There were five primary purposes of training:

1. Introduction of PC-DOS.

2. Introduction to IBM PC Junior, RGB Monitor, and Graphic Printer and Modem.

3. Use of the following programs: IBM Writing Assistant; IBM Filing Assistant; IBM Reporting Assistant; IBM Graphing Assistant; Multiplan; IBM LOGO; Personal Communications Manager; and Wordproof. (Later, IBM Planning Assistant was used to replace MULTIPLAN). Also, heavy emphasis was placed on using these programs in the context of the K-12 curriculum, e.g., using Filing Assistant to develop a database about the 13 original colonies and asking questions about the database, i.e. how many had a population greater than a given size. Some instruction was devoted to programming in BASIC, writing interactive programs with LOGO, and music simulation.

4. Evaluating classroom software.

5. Using specific peripherals, e.g., Koala Pads.

Training Alternatives

There was a two-stage initiative developed by NCTI and tentatively approved by IBM. Phase I was the training of 100 teams of computer-using teachers associated with K-12 education, and the development of 100 sites at which further training of teachers and others could take place. For all intents and purposes, Phase I was successfully completed. Ninety-seven sites and 194 trainers representing the major population areas of the United States and the District of Columbia were selected and prepared in 1984, and the majority of programs were in place by January 1985.

Phase II, according to one NCTI official, was crucial to the ultimate success of the project. It never took place. Phase II called for IBM to market the IBM PC Junior to teachers and educators "at a ridiculously low price"—perhaps as little as $500 per system. With each system sold to a teacher, two coupons would be included. One would be worth seven free hours of personal use computing at one of the NCTI sites. The second would be worth a substantial rebate on the 40-hour NCTI course designed specifically for classroom teachers. The theory was that, in order to get teachers to use computers in the classroom, teachers first had to become familiar, competent, and comfortable with the hardware and software. To do that it was desirable that teachers have computers in their homes.

Participants reported the program provided an extremely effective learning environment. Instruction took place in the Lawrence Hall of Science from about 8:30 to 5 pm daily, five days a week for two weeks. There was one large lecture hall equipped with 50 computers with sufficient space to handle two individuals per computer. There were at least four other labs of 25 machines each for individual use. Thus 100 students could be active in the large hall, two to a machine, while the other 100 had access to machines individually.

The students lived in several dormitories on the UC campus. A room on each floor was equipped with four to ten machines for evening and weekend use.

IMPACTS AND FUTURES

Five Reasons for Failure

NCTI was out of business within one year of the start of the training program. So far as NCTI was concerned, the venture was a failure. The reasons suggested for the failure include:

1. NCTI's inability to comprehend the market, the nature of the competition, or the marketing strategy necessary to make a training program of this type profitable.

NCTI relied on two major marketing strategies: a national direct mailing and publicity campaign to public and private schools and selected professional newspapers; and the ability of the local NCTI instructional teams to market the program locally. In retrospect, it would appear that NCTI did not realize that:

- National direct mailing campaigns to schools seldom get beyond the principal or superintendent, and if they do, find themselves posted on already cluttered bulletin boards competing for visual space with a wide range of activities, conferences, and training opportunities.

- To make a national mailing campaign effective required a brochure so complex and "busy" as to be difficult for most to read, or so general that a second step—in this case a response to a Fremont, California, address or a call to a toll free number—necessary, which delayed response and perhaps confused or discouraged potential participants.

- In the large population centers, where most of the NCTI sites were located, NCTI was competing against existing colleges and universities which in many cases had computer courses of one kind or another in place. NCTI asked the local site coordinators to find ways to obtain "local college or university credit" for the course. In many cases, the NCTI cost of the course, without credit, was higher than the local college or university charged for similar courses with credit. Participating NCTI site teams often had trouble getting local colleges and universities to agree to provide "cut-rate" credit for competing courses.

• NCTI Site Teams were selected on the basis of their experience with computers, their interest in the NCTI program and their ability to deliver a local, cooperating school site. They were not selected on the basis of their ability to market local programs, nor were the teams provided any formal training on local marketing at the Berkeley training session. Consequently, many local sites failed to host any self-supporting training classes.

2. IBM's slow response to hardware/software problems of the PC-DOS and the Junior, and the premature 'apparent' withdrawal of the Junior from the market.

• One of the earliest "concerns" about the PC Junior keyboard was its "chiclet" style keys. The "chiclet keyboard" was probably acceptable for children—perhaps an excellent choice for children—but for adults who had developed touch-typing skills it was a monumental disaster. The "chiclet keyboard" was standard at the Berkeley training session, although several replacement keyboards were shown. By October, the replacement keyboard was standard, but the public relations damage of the " keyboard" was done.

• Similarly, IBM had commissioned a version of Microsoft DOS for the PC Junior. Called PC-DOS, there is some doubt whether there was even a byte or a bit of difference between it and MS-DOS. But the DOS was proprietary, which meant that it had to be loaded separately into the Junior's RAM, which was originally delivered with one drive and 128 K of memory. The IBM PC Junior with this configuration required a complex form of loading and disk swapping in order for an application to work with, for example, IBM's Writing Assistant.

The Assistant series came with an original disk that had a complex system for making one backup copy which, in the process, modified tracks on both disks (the original and the copy) so that further copies could not be made. This process required a large number of "disk swaps" by the user. It should be remembered that the NCTI teams were selected on the basis of their experience with computers and their interest and willingness to participate in the NCTI program. By definition, in the spring of 1984, when they were selected, this almost guaranteed, certainly among school teachers, that the majority would be Apple users, and Apple users had already discovered the definite advantage of dual disk drives and limited protection schemes. The IBM protection scheme and single drive system alienated a large number of experienced users.

• In March, 1985, at a time when most sites had less than six months to market a course with an operational laboratory, USA Today and National Public Radio released a story that IBM was "withdrawing" the Junior from the market. It was finally determined that IBM had only terminated its current production contract with Teledyne; but any marketing of the Junior to a school population, most of whom find ways to purchase equipment at the end of their fiscal year (June through September in most states) was severely hampered.

3. IBM and NCTI's joint failure to understand the attractiveness and the importance of the installed base in public schools held by Apple.

> • The IBM PC Junior was going up against a major installed base of Apple II+, IIc, and IIe computers. In retrospect, its would seem obvious that, to replace Apple, would require a better computer, an easier computer to use, a wider variety of less expensive software, at reasonably comparable costs, and a committed user-base among educators. Arguably, the Junior with its superb RGB color and excellent three voice, 8-octave sound system was a better "box." It was harder to use, had less software, was only comparably priced, and had very little chance of converting experienced Apple users among school personnel.

4. A lack of inexpensive, quality software for the PC Junior, as opposed to the large amount of relatively inexpensive software for the Apple, via consortia such as MECC.

> • When the Minnesota Educational Computing Consortium chose Apple as the computer they would support for Minnesota, and produced a vast amount of software for the II series, it made entrance into the educational marketplace by IBM a much more difficult task. It can be argued that, on the average, the IBM PC Junior software was of higher quality than the average of the MECC-supported and public domain software available for the Apple. Be that as it may, it was also true that the average cost of a PC Junior program was substantially higher than one of the MECC series, and often had copy-protection schemes which did not provide for archival or backup copies. (At the same time, MECC was making state, district, and institutional site licenses and copying agreements available at very affordable costs.) In an arena where novices predominated, and no specific standard of quality for software had been set, purchasing many different programs for the cost of a few appeared to be very attractive, particularly when some of the inexpensive software was of excellent quality and some of the expensive software hard to use and/or of only fair quality.

5. Was the Junior a poor machine, or was it a victim of poor PR and untimely withdrawal from the market? And if it was, is that a major reason why the NCTI training effort was not a success?

> Some aspects of this question have been discussed above. The one drive system combined with the proprietary PC-DOS, plus the complicated anti-copying protocol on much of the IBM software provided a tedious exercise for a set of teachers (NCTI trainers) who were experienced on less complicated, dual drive systems. The chiclet keyboard was, to almost everyone who used it except children, an embarrassment. The Junior certainly was overpriced at the beginning, particularly when it is realized that a full system including RGB monitor could be purchased at some local dealers for under $600 by Christmas of 1985.

Costs

It is very difficult to estimate the cost of the training. For one reason, it is impossible to know exactly what pre-program costs of NCTI were underwritten by IBM. From the beginning of the training program to the end of the program, some baseline estimates are possible.

Providing 100 sites with 17 complete hardware systems approached $1,700,000.

IBM also provided each site with 17 sets of software including MS-DOS, four programs in the Assistant Series, Multiplan, Wordproof, IBM LOGO, Basic and Personal Communications Manager. The total cost approached $ 2,000,000. This does not include individual sets of software provided to each site on a demonstration or trial basis.

IBM/NCTI transported approximately 200 participants to Berkeley for two weeks training. Some came from as far away as Alaska, Hawaii, and the east coast of the United States. Transportation costs are estimated to have been $ 75,000.

IBM/NCTI provided two weeks of meals and rooms at Berkeley. This cost is estimated to have been at least $36,000. There were also entertainment costs, local transportation costs, rental of the Lawrence Hall of Science, shipping and handling costs, staffing expenses, and the like.

Clearly NCTI had both preprogram and post-program expenses, and IBM had a great involvement in assisting the program by in-kind contributions. NCTI was clearly paying its officers, staff, and some of the instructors during the program, and had heavy advertising and administration costs after the training program was completed. Depending on how costs are assigned and estimated, probably the total operation cost exceeded $5 million.

Why did Phase II not take place?

There are at least three possible explanations, none of which are mutually exclusive.

• First, the small computer division of IBM was the newest, smallest, and least influential of any division within IBM. Creative and innovative marketing strategies from this group always appeared to meet resistance at the higher levels of IBM. Combined with the general slowness with which IBM responded to both the market place and internal suggestions, this delayed and eventually voided the implementation of Phase II.

• Second, it has been suggested that IBM legal counsel were very concerned about a possible unfair trade practices suit if IBM were to market the PC Junior at such low cost that it would substantially interfere with Apple, Tandy, and Commodore success. IBM had been a target of several monopolistic and unfair trade practices suits over the years and may have been substantially influenced by this possibility.

• Third, Phil Estridge, a senior official of the small computer division who was most responsible for IBM's commitment to the NCTI/IBM initiative was killed when the Delta airliner crashed in Dallas on August 2, 1985. The loss of this high level, respected, and committed supporter probably sealed the fate of Phase II.

POLICY ISSUES

A number of NCTI trainers, many of whom had extensive experience with Apple II and other systems prior to the 1984 training session, and who worked, with varying degrees of success, to make the NCTI initiative happen, were recently interviewed. Equity and funding issues were not deemed significant. They suggested the following conditions would have been necessary to make the effort a success:

Coordination and Planning for Success: 3 Necessary Conditions

1. Either the IBM PC Junior needed to be a two-drive system from the beginning, or the complicated copying protocol should have been eliminated, or each team should have been given a two-drive PC to use for administrative and demonstration purposes. The least expensive avenue might have been the third, since the IBM PC Junior has proven to be an excellent machine for certain applications, particularly those used by students in class in a CAI, drill and practice, programming or simulation mode. Many trainers felt they were spending (wasting) valuable time on tedious, routine applications which could be carried out much more rapidly on other systems.

2. The lack of software for the IBM PC Junior was important. Had IBM contracted with organizations such as the Minnesota Educational Computing Corporation to translate the Apple DOS educational software to MS or PC DOS format, school systems would have been provided with a source of a large number of inexpensive educational disks which might have made IBM Junior purchases more easily justified. A recent interview with one of the MECC staff indicated that there was still today an insufficient installed base of IBM's to make conversion of all existing software justifiable.

3. In retrospect, it seems apparent now that no effective marketing research took place prior to the formal implementation of the NCTI/IBM initiative. Marketing research should have, in advance, determined where potential students were, where college or university credit could have been obtained easily, what state teacher certification standards and salary incremental increases would have encouraged teachers to participate in the program, what competing price structures were, and where commitments to house the program and laboratory could be obtained. (At least one site never installed the laboratory because of the district's resistance to have a "business operating out of a school building." Information of this type could have been obtained prior to the invitation to the site team.)

Training

One of the comments made by selected NCTI trainers was that having the IBM PC Junior system available for home and personal use was a major factor in helping them master the software and finding ways in which the system could be integrated into the school's curriculum. While it is true that most of these individuals were computer users before the NCTI training program, it is relevant that even these experienced users—mostly Apple users—found it valuable to have personal systems available at home for their own development. This is probably the case with the majority of teachers regardless of their degree of experience or training.

At least one school district has found this strategy to be useful. In Washington state, a district of 1200 teachers is training approximately 950 volunteer teachers on the Apple GS computer. Teachers who complete nine days of inservice own the computer! Teachers who complete an additional three days are given a printer!

Purposes of Technologies Instruction and Training

NCTI/IBM probably made a mistake by focusing on school-based (as opposed to University or College based) sites for training. The school-based site teams were asked to negotiate with local colleges and universities to give credit for the training experience, in most cases adding to the basic cost of instruction. What would have happened if NCTI had approached 100 colleges/schools/departments of education across the country;

particularly those who had demonstrated a commitment to computer technology but had not been able to develop either the lab, the teaching expertise, or the course content? These organizations had built-in student bodies, marketing offices, and credit courses. Perhaps it was a marketing decision: NCTI might be able to "turn a profit" using local entrepreneurs on non-college sites. Perhaps it was philosophical. "Teachers training teachers" might have been viewed as a better marketing strategy than professors training teachers. Perhaps it was basically public relations. IBM, who has a historic and traditional relationship with higher education—particularly with the main-frame dominated University computer centers—possibly wanted a visible relationship with public schools, teachers, and students. Perhaps, IBM and NCTI saw the value of having the laboratories located where they were most accessible to K-12 students and teachers. Perhaps it was a combination of these factors. In any event, from the NCTI point of view, and from IBM's, the experience was a failure.

CONCLUSION

The IBM/NCTI initiative was a joint effort between a major hardware manufacturer and an organization, the expertise of which was in the delivery of training. NCTI had staff with extensive experience in the use of computers in the classroom and teacher training. By and large, the trainee-participants were experienced teachers at the K-12 level. NCTI training sites were located in 49 states and the District of Columbia, ordinarily in laboratories in K-12 schools. This initiative recognized three important aspects of a successful training program. First, the approach was to select excellent and experienced teachers and train them to use the technology as a tool for teaching and learning. Second, the technology was made available to the participants so that they could use it and experiment at home with it at their convenience. Third, the training program and NCTI manual emphasized the integration of the computer technology into the existing K-12 curriculum as a learning tool.

The major policy implications include the need to provide affordable, compatible technology for teachers and to continually develop models to integrate computer learning into the curriculum as a learning tool.

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LESLEY COLLEGE COMPUTERS IN EDUCATION PROGRAM:
A National Program From A Massachusetts Base

INTRODUCTION

Lesley College is a small college located in Cambridge, Massachusetts, offering graduate and undergraduate programs in education, human services, counseling, creative arts, and management studies. In its education program, Lesley offers a master's degree, as well as an undergraduate specialization in "*Computers and Education* ."

The undergraduate program is entirely residential. The graduate program is offered on campus and through regional and national outreach external degree components. The program in Computers and Education was developed in 1980 as a residential program, one of the first in the country. Since 1981, the graduate program has been offered through the regional outreach office covering New England and via the national outreach program. National program operations have centered in the West and Midwest, especially Colorado. The regional and national programs are offered using an intensive weekend model in which students attend classes for 19 hours on two weekends separated by three or four weeks. The campus model involves a conventional 14 week semester and most courses meet in the late afternoon or evening.

The graduate program in Computers and Education currently has an enrollment which exceeds 1000. Over 80% are enrolled in the national outreach courses, and the rest are enrolled in the campus and regional program. Headquarters for the national outreach program is in Cambridge, Massachusetts, but the center of its operations is actually in Greeley, Colorado.

Lesley also provides in-service programs on a "request" basis to school districts or consortia of school districts, primarily in the Boston area. In addition, Lesley sponsors an annual, campus-based spring conference on education and technology which is attended by educators at all levels from the entire country. Finally, each summer Lesley sponsors a conference, usually in Colorado, for graduates and current students enrolled in the Outreach Computers and Education Program.

Lesley was one of the first colleges to offer practical, "hands-on" microcomputer courses in an education program. Since, 1981, the College has trained over 7000 educators now actively engaged in technology and education activities, particularly in the western part of the United States.

KEY ACTORS AND EVENTS

Development of the Outreach Program

About 1979, Dick Wylie, then in Denver, accepted an offer to become Vice President and Dean of Education of the Graduate School at Lesley College. Upon his arrival at Lesley, Wylie (now President of Endicott College in Beverly, Massachusetts) initiated the national outreach program, partly prompted by Frank Cordell, then a professor in the American Studies Program at the University of Northern Colorado in Greeley. Both Cordell and Wylie had a long-standing interest in outreach education, and this proved to be a perfect opportunity for them to collaborate. Cordell resigned his position with

Northern Colorado and, with his wife, established Professional Outreach Associates (POA). Their first (and only) contract was with Lesley.

In 1981 POA began to market the new graduate program in Computers and Education which had been developed the year before at the Cambridge campus by Nancy Roberts. Susan Friel was developing simultaneously the undergraduate program. Roberts and Friel both had been public school teachers in the Boston area, and they had met while Roberts was enrolled in a doctoral program at Boston University. Roberts and Friel both had contacts in the Boston "high tech" world and, drawing on these contacts, had designed programs that reflected the needs of the time: literacy; programming skills; LOGO (Seymour Papert was working at MIT on LOGO at that time); and simulation.

Sensing that the time was ripe for an expansion of Lesley's outreach program into this arena, Cordell began to try and put together some teaching laboratories. Unable to secure funds, he mortgaged his house and bought 10 Apple IIs. Lesley, or more precisely POA, had its first computer lab. At about the same time, Cordell approached John Pepper, Superintendent of Schools in Jefferson County, Colorado (Denver suburbs) who had decided to actively involve his district in the use of computers and who was looking for a source of training. Lesley's new program seemed to meet his needs for training his teachers. Cordell placed the lab in the Jefferson County Schools, and Lesley began to recruit students in significant numbers.

Cordell then wrote a proposal to Apple for 120 computers in order to equip 10 additional laboratories. After several months of not having a reply from Apple, Cordell visited the corporate offices in California. There was still no reply. More phone calls were made. Then, suddenly, Cordell got a call asking where the 60 computers that Apple was donating to the program were to be shipped. Overnight Lesley now had six labs. Meanwhile, in Cambridge, the campus program was also approaching Apple Computers, Inc. In 1987, Lesley received 20 GS computers to expand its campus laboratory.

POA has been the major recruiter of students for Lesley (in all programs: education, management, and human services). POA also arranges field sites, supervises site coordinators, establishes contacts with local school authorities, prepares applications to state agencies for permission to offer courses in states in which Lesley currently does not operate, and markets the Lesley program.

The Role of Universities and State Agencies

Expansion did not take place without opposition from local officials and other educational programs. POA prepared applications seeking authorization for Lesley to offer courses in a number of states and submitted them on behalf of Lesley. Many of these applications met significant resistance from state authorities. Some states perceived Lesley as staffing masters level courses with master's degree staff rather than with staff holding doctoral degrees. When Lesley proved that state institutions were doing the same, opposition was withdrawn. In other states, Lesley students received notices such as: they would be ineligible for certification because the programs being offered by Lesley were not being offered by computer science faculty; graduate credit in a field outside of the teachers "specialty" would not be approved by the state for advancement; residential faculty (living in that state) must teach the courses; Massachusetts (the official home of Lesley) had not established "computers and education" as an "approved" program; in order to offer courses in the state Lesley's proposed courses must first be approved by the Deans of Education at all state institutions. And in one case, Lesley's application was lost, then buried at the bottom of the applications pending, then sent back for correction of clerical errors, following which the process began again.

But Lesley persevered and now offers, through the national outreach program, 127 sections (each with 20 degree candidates) at 20 sites in some 10 states. POA's largest outreach efforts now extend throughout Colorado, Arizona, and Wyoming. Programs have also been established in Wisconsin, Missouri, and New Mexico. Plans exist to add 27 additional sites in the near future.

REASONS FOR LESLEY'S SUCCESS

Given the opposition of the local educational institutions to Lesley's activities, and given the less expensive tuition charged by state institutions, we were interested in why Lesley was more successful in recruiting students than other programs.

There are several apparent reasons that emerged from conversations with Lesley faculty, alumni, students and the POA staff.

1. **Lesley started first.** Its program was one of the first in the country explicitly combining an interest in education and computers.

2. Lesley's **approach is practical rather than theoretical.** This was cited over and over again by students as a major deficiency of traditional programs. The argument takes two forms: "the University professors have never taught in a school like mine;" "the University professors can only deal with theory, or 'meta-theory'. They do not know how my class and my school 'really work'."

3. Lesley **staffs its computers and education program with teachers, practitioners,** and others closely involved in precollege education. In the first days of the program, Lesley hired Cambridge-based, early computer activists to teach their computer and education courses. These early activists were people bridging the gap between education and computing, especially those influenced by the work being done by Seymour Papert and others at MIT. Later, Lesley began to hire its own graduates to staff its courses. Lesley graduate students were recruited to teach on the main campus while working on their master's degrees. This also occurred in Colorado, and wherever the national program was growing.

4. Because Lesley has a tradition of having a very small permanent faculty and no tenure, and because Lesley relies heavily on adjunct faculty, **appointments could be made quickly**. Lesley could draw on professionals with other full-time jobs who wanted to earn a little extra money by working two weekends and who wanted a chance to interact with some new people with new ideas.

5. In part, Lesley's success can be attributed to **the inertia of higher education**. When Lesley began to offer these courses, traditional institutions had few trained staff on their faculties, and budgetary and tenure considerations made hiring qualified faculty in the area of computers and education extremely difficult. Where universities did respond quickly and innovatively, such as in Albuquerque where the University of New Mexico teamed to offer courses in conjunction with the local school authority (local teachers were used as instructors and practical approaches to computing were emphasized), Lesley had little success in recruiting students.

6. University **courses which were offered by other institutions were too technical**, reflected too much reliance on "computer science as a core" rather than emphasizing the

use of computers as tools in discipline based instruction. Lesley emphasized the use of computers; other institutions emphasized technical knowledge of computers and programming.

7. Lesley was **able to modify its program quickly.** There have been at least three phases in Lesley's program. At first, it involved establishing comfort with computers, literacy and programming. In the second phase, Lesley decreased the emphasis on programming; completely reworked the literacy portion; downplayed comfort; and broadened its program. The new program areas include: software evaluation; new technologies such as interactive videodiscs; simulation and robotics; and applications programs including word processing and databases. In the third phase, which has recently begun, Lesley is concentrating on the integration of computers throughout the curriculum and turning its primary attention to the questions about teaching and learning that are raised by a technology rich (or at least modestly so) teaching environment. Technology training is no longer the objective. Being able to use technologies to achieve educational objectives is.

Few, if any, of the traditional programs with which Lesley competes are able to modify their program so drastically, so often, and so quickly.

8. Lesley delivered **courses at convenient times and in convenient places.** The weekend format for working teachers was of great benefit to Lesley. Teachers could come (males more easily than females according to POA staff) on weekends, and liked that format. They also liked being able to take courses in their own schools in their own communities, or in nearby communities, all places where graduate programs seldom or never had been offered before.

9. **Lesley's faculty were teachers.** Earlier we commented that this was cited in its negative form as an explanation of why University faculty were too theoretical. In its positive form it was cited as a real plus for Lesley by many of teacher trainees interviewed for this project.

10. Lesley has **a reputation for offering a "good program"** among teachers and administrators in the regions where they are especially active. During the course of our interviews at other sites, we received numerous, unsolicited, positive comments that Lesley had provided a "a good program" for teachers.

11. The outreach nature of Lesley's operation, its organization as a separate division within Lesley, and Lesley's relationship with Professional Outreach Associates provided much of the **flexibility and quick response** time that has characterized the Lesley program.

STUDENTS

Who were and are Lesley students? The overwhelming majority enter as teachers. Most, according to Lesley and POA officials, stay in the teaching profession. Many have become computer specialists at district or building levels. Several are now superintendents or associate superintendents. Others have been recruited to join the permanent staff for the Cambridge campus program. But most are still teachers. Lesley has attempted to recruit administrators into their program, with little success. They are unsure as to the explanations for this.

Lesley has been most successful in recruiting students from schools in districts where the superintendent or a principal encourages his or her teaching staff to "get involved with computers." For example, Lesley officials estimate they have trained over 500 Jefferson County, Colorado, teachers; 100 or so from Aurora, another Denver suburb. In the city of Denver where the teachers are older and at higher grade levels, and where there has been less of an emphasis on computers, fewer than 50 teachers have taken Lesley courses.

Lesley reports that districts which encourage teachers to acquire masters degrees through pay incentives produce a large proportion of their students. In areas where masters degrees are not rewarded with additional pay, or where teachers are generally at the top of the pay scale, recruitment is much more difficult.

Another attribute of a district which seems to discourage broad participation from teachers is control, or heavy influence over, computer programs by management information system personnel rather than educators.

Lesley also reports that students seem to come in teams, usually three to five teachers from one school, sometimes as many as eight or more. In fact, Lesley offers to set up programs wherever a group of 20 students congregate.

Although the national and regional outreach enrollments are expanding rapidly, the enrollment on campus has declined for the past three years. Lesley faculty attribute this decline to the higher costs of the on-campus program; increased competition in the Boston area; the absence of a concentrated weekend teaching model on campus; and the availability of programs (sometimes Lesley's own) at nearby locations.

Of the 7000 students trained by Lesley, some 2000 have completed the master's degree program, over 4000 have completed one or more courses, and more than 1000 are currently enrolled and taking courses.

FACULTY

Lesley now has a Cambridge-based full time faculty of five, a majority of whom are Lesley graduates, and a pool of 130 national outreach faculty supporting 15 distinct courses. Most of the outreach faculty are Lesley products. Lesley draws extensively on their own graduates as faculty, citing that their graduates are trained in using technology throughout the curriculum; practically-oriented (as opposed to theoretical); interested in educational questions, as well as technology; and experienced as classroom teachers in elementary and secondary schools.

When questioned about quality control for instruction, Lesley officials interpreted this as being a question about quality control for outreach faculty. They responded that although this is a constant concern, it has not been a problem. One estimate we were given was that only about 3% of the instructional staff (and they have used many different people) had been identified as problem teachers by either students or staff.

Lesley uses several approaches to maintain quality. They use midterm and end-of-course evaluations. They respond immediately to any telephoned complaints about teachers, trying to assess the nature of the complaint and its validity. They have their resident faculty regularly teach in the field in order to work with field faculty and to get feedback from students. The on-campus faculty keep rather tight control over the design of courses and make virtually all educational decisions regarding the composition of the curriculum. (Field faculty have, however, redesigned several courses and even introduced two courses into the curriculum.) In 1987, Lesley brought five field faculty to campus to join the 5 campus based faculty for a series of in-service workshops. They intend to continue that process next year.

Lesley has identified several areas in which they wish to change their faculty. They want to expand it so that they can serve more external sites. They have a goal of including more women among their field faculty, especially since a large proportion of their students are women. Lesley is also cognizant of the need to add additional minority faculty to its pool of instructors.

LOCAL SCHOOL BOARDS

Lesley reports a variety of responses to their program from local school boards.

Several boards have been reluctant to have their computer equipment used by Lesley to teach their teachers. In other cases, school boards have opened their facilities to Lesley and readily made their equipment and space available for instruction. Some boards have raised objections about the added costs that they will incur as a result of opening their buildings at night and on the weekends. None, however, have raised questions about the additional costs (sometimes significant) that will ensue if a number of their teachers get master's degrees. One district, Colorado Springs, did have financial difficulty for exactly that reason.

In still other cases, local boards have authorized partial tuition reimbursement payments for teachers participating in the Lesley program.

TRAINING

Approach

Lesley emphasizes a practical approach in their training. They are now concentrating on questions of integration, and questions of education that flow from the uses of technology. Technology is definitely seen as a tool, not an end in itself.

Format

As noted Lesley uses a traditional semester format on campus and a concentrated weekend format in their outreach programs. Inservice workshops, especially in the Boston area, and conferences are also important to Lesley's mission.[1]

Incentives

Lesley pays a relatively low $1,500 for teaching a weekend format course (38 hours of scheduled classroom contact, usually over two weekends). Although on-campus faculty salaries were not revealed, individual faculty commented repeatedly about their low pay and long hours. Lesley does not provide its permanent faculty with computers and several have brought their own computers to work.

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1. Appendix A provides a detailed description of admission requirements, program of study (required and elective courses), field placements, and summer program option.

IMPACTS AND FUTURES

The growth of Lesley's national outreach program, coupled with the decline in enrollment at the main campus, poses some unique problems for Lesley. The main campus has been, and intends to remain, the center of the academic program. With reduced resources resulting from decreases in enrollment, this may prove difficult. It is already acknowledged that it would be easy to start a Colorado campus. But there is strong resistance to that, and state regulatory considerations would also most likely interfere. The main campus faculty also report growing demand to complete their doctorates, and to publish. This has strained the faculty in many ways. The practical approaches to the use of technologies, and the use of experienced primary and secondary teachers - both keys to Lesley's success - may suffer. And it is to be expected that the willingness of the faculty to do outreach teaching will diminish as faculty devote more time to additional education for themselves, and to research. This may interfere with one of the quality control mechanisms now in place.

Large scale growth is planned, however, for the national outreach model.

Although there is no doctoral program in place in Computers and Education at present, it is possible for students to design their own program and thus complete a doctorate in Computers and Education at the main campus. There is some talk, although none official, that a graduate program in education and technologies might be an appropriate next step. There is even some informal exploration of the possibilities of an outreach doctorate, but the problems in obtaining approval in several states for such a program are seen to be enormous.

Lesley is continuing to expand its efforts in robotics, interactive videodisc instruction and development, and artificial intelligence applications.

FEES

Lesley charges $135.00 per credit hour in the outreach program; the on campus program costs almost twice that amount.

POLICY ISSUES

Equity

This is not a significant policy issue for Lesley. But Lesley faculty and staff observe that it is an issue for the clients whom they serve. They believe the gap between the technologically literate and the non-literate is getting wider in the educational systems with which they come in contact. They also see a third group emerging: the teachers and systems which still see the focus as technology and have not moved beyond that stage to look at the educational issues that need to be addressed when technologies become widespread and are truly used as tools. What is surprising, they note, is that some of the districts which were the early leaders in purchasing technologies are among those having the greatest difficulty in adapting to the new thrust.

Training

Officials at Lesley express concern that their program seems to be almost the sole source for practically-oriented college faculty in education and technology who are as, or more, interested in educational questions than in the technology. Seen positively, Lesley is doing what it feels needs to be done. Seen negatively, Lesley officials raise questions about the current training programs in schools and colleges of education across the country, and express some concern about the impact of constantly drawing on their own graduates for their teaching staff.

A corollary policy issue concerns what is to be done to retrain existing university and college level faculty. Retraining needs include training faculty to use the new technologies as tools in their instructional offerings; to teach that to others; and to understand that the integrative approach removes technology from center stage and makes educational issues the major focus.

Some faculty at Lesley also believe that the stage has been reached when the name of the program should emphasize the use of technologies in subject areas, for example "Using Computers in Social Studies." Better yet, they argue, call the course or workshop "Latest Advances in Social Studies." "Don't mention computers," they say. "Our focus really is on social studies. The computer is a powerful tool in helping us address issues involving social studies (or any content area). But it is social studies, the subject area, that is important - not technologies."

Funding

The Lesley experience highlights the necessity of having equipment in order to engage in effective training. Lesley understands the need for technology resources for instructors; for new equipment and new technologies in their teaching laboratories. Lesley has no endowment and insignificant unallocated cash resources. It operates almost entirely from tuition and grant revenue. Acquiring investment capital, and being able to depreciate capital equipment over a realistic time, have proven to be elusive goals. These same problems face many of the post-secondary institutions in this country and should be considered a serious policy question. It is probably a partial explanation as to why the post-secondary institutions of education in the United States seem so uninvolved with new technologies.

And yet Lesley has captured a leadership position. Many of the reasons for this were discussed above in the section entitled "Reasons For Lesley's Success."[2] But an additional explanation may also be appropriate when considering financial issues. A contractor, not an employee of Lesley, mortgaged his house because he saw an opportunity and was willing to take a risk. It was not that he wanted to take the risk personally. It was just that the institution could not for a myriad of reasons, even though both Lesley and the contractor would benefit financially from increased enrollments. And one company, Apple, donated over 60 computers that enabled the program to grow and flourish. In the absence of a policy committing the necessary funds to address the future (whether it is at the state, local, or national level), institutions and programs become far too dependent on individual or corporate risk-taking, generosity, or chance.

State and Local Regulations

Lesley feels unfairly stifled by rules and regulations which they see as designed to protect state based institutions from competition when state-based institutions are not addressing current needs. They would like to see these restrictions eased, or at least not be applied to them in a discriminatory fashion. They note that they are always challenged with the word "quality" when such issues are raised. They question the wisdom of basing quality judgments solely on inputs (e.g., the number of books in a permanent library, the residence of a faculty member, the number of hours spent in a chair in a classroom). Instead, they suggest looking at outputs. Do the Lesley graduates have the skills and knowledge, the attitudes and approaches that will make them successful? If so, that should be a sufficient determinant of quality, and acceptable ways should be sought to document this.

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[2] See above, p. 91.

Lesley staff also contend that "quality" is often used as a substitute for "theoretical" or "meta-theoretical." They contend that to exclude attention to the practical needs of society is a misuse of the vested powers of established educational institutions.

In some situations, Lesley has been prohibited from offering courses because it does not provide a research library. Lesley officials raise questions about such policies. With the availability of electronic data retrieval systems of enormous size and complexity, a computer, a modem, a telephone line, and resources to pay for the search make fixed libraries redundant, even inefficient. Lesley is teaching how to use such resources. But current rules in many states do not allow the substitution of such resources for traditional libraries.

Certification

Lesley would like to see certification requirements that mandate teacher training in "specialities" or "curricula areas" be interpreted to include instruction in the use of technologies as an integrated approach across disciplines and specialities. It is that emphasis that they are now stressing in their program, not technologies, per se.

CONCLUSION

Lesley College presents a fascinating example of what risk taking, good ideas, lots of energy, and timely decision making can accomplish, even in the face of indifference of peers or resistance from peers and state agencies and more traditional teacher training institutions. Teachers teaching teachers; an emphasis on integration of technology - on the educational issues that grow out of using technology; the impediments to change masquerading as "reforms" or "quality assurance;" the necessity for resources to purchase equipment (or luck and good fortune in otherwise acquiring it) are all key features of this case study.

FOR ADDITIONAL INFORMATION

The principle contacts for this project are:

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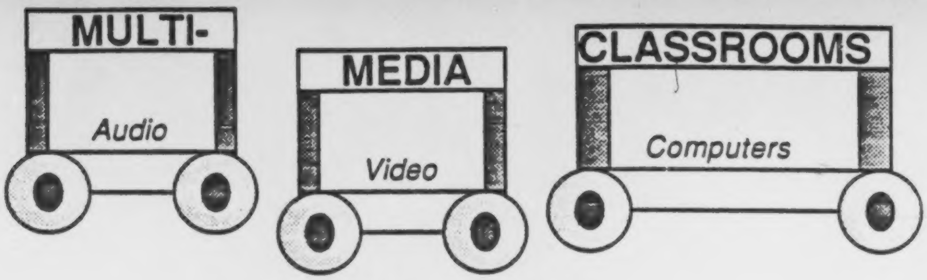
The principle written material concerning this project is the Lesley College Catalog. The Computers in Education Program also issues periodic mailings and reports.

APPENDICES

APPENDIX A

Jefferson County, Alabama, School System, Selected Published Materials on the Multi-Media Approach

"Multi-Media Classrooms: The Project; Its Goals."
"Multi-Media Lab Inventory"
D'Ignazio, Fred. "Start A Multi-Media Classroom in Your School."
D'Ignazio, Fred. "It's the Mentality, It's Not the Money." Instructor, Fall, 1987.
Jambor, Mara. "Cahaba Heights Model for Multimedia Classes."
Trammell, Mary Jaq. "Multimedia Sandbox." Birmingham, May 1987.
Multi-Media Classroom Kit Order Form.



Little Carts on Wheels Bring Multi-Media to Every Classroom

The Project

Fred D'Ignazio is the author of twenty books on science and technology, a popular columnist for COMPUTE! magazine, and a TV commentator for ABC-TV and PBS. Since 1985 he has been working on a novel approach to train teachers in high technology and create multimedia learning centers in elementary-school classrooms.

In May 1986 Fred began conducting teacher workshops in Birmingham, Alabama, British Columbia and Saskatchewan, Canada, which continued through December. The workshops trained teachers in creating multi-media presentations in critical subjects, including math, science, language arts, and social studies.

Teachers in Alabama and Canada became so excited by the workshops that Fred created the Multi-Media Classrooms Project which eventually encompassed 26 schools, 100 teachers, and over 3000 students from kindergarten through the eighth grade.

During the course of the 1986-1987 school year the 26 project schools put together their own multi-media centers out of equipment teachers found around the school. The teachers appointed a school coordinator who checked out the equipment, locked it up at night, and shopped for deals on batteries, videotapes, audio tapes, and computer diskettes. Teachers developed dozens of lessons -- on Indians, ecology, grammar, counting, estimation, pronouns, etc. Since the equipment was scarce, students spent most of their time planning their productions, thinking about sound effects and camera angles, and imagining how best to present their subjects. Other students joined Media Clubs and learned how to use the equipment. Media Clubs were a hit, and Media Club kids were soon in demand by the entire school.

On May 13,1987, project schools held the first Annual Multi-Media Classrooms Festival at the corporate headquarters of Alabama Power in Birmingham, Alabama. National sponsors and distinguished educators from around the U.S. and Canada flew into Birmingham, participated in festival workshops, and attended the numerous exhibits hosted by project schools.

Its Goals

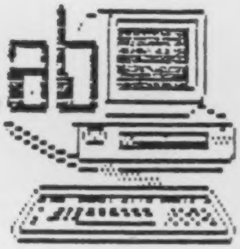
In its first year the Multi-Media Classrooms Project benefited students in numerous ways, but teachers felt the three major gains were: (1) A dramatic improvement in students' oral and written communication skills; (2) An increase in students' interest in core curriculum subjects (math, science, reading, writing, etc.); and (3) A noticeable increase in students' self-esteem.

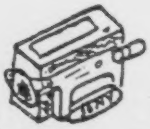
Teachers have witnessed such success with their children because they themselves have succeeded. They have embraced technology like never before (witness their all-night "Media Maniac Parties" with other teachers), and they have recovered their own joy in learning and their joy in giving their students new opportunities to learn.

The two key metaphors for the project have been the sandbox (for the teacher) and the studio (for the student). Both metaphors are sources of power: they empower teachers and they empower students. When teachers see technology as a sandbox, they realize they can leap in, play, experiment, and learn from experience without fear of failure. And students come to see the classroom as a studio, a studio in which they are the producers. Their productions are in the minutiae of the curriculum: fraction plays, word problem videos, science radio, "The Story of M.I.S. Prefix," and Pumpkin Math soap operas. Student producers write scripts and draw storyboards about everything they learn. They try to imagine how to communicate what they're learning to their "studio audience." And in the process of communicating, they learn their subjects more thoroughly, more energetically than ever before.

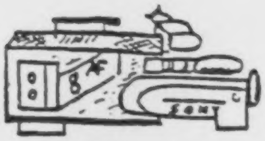
Where do schools get the money to be able to afford all this multi-media? They don't have any money; they're in a crunch just like every other Alabama and British Columbia school. One of the slogans of the project is "Be a high-tech pioneer on a low-tech budget." To raise money for cassettes, tapes, and disks, the schools hold skating parties, dances, and shows. They "adopt" local high-tech companies to get a discount on equipment repair, new computer paper, printer ribbons, and videotapes. Most schools have a cassette player, a VCR, and a computer. That's ALL they needed to get started! If you put these three items on a little plastic cart, you have a "Multi-Media Center." You're an instant pioneer on the cutting edge of high technology. Now all you need is the Multi-Media Classroom Kit, and you are on your way!

Multi-Media Lab Inventory

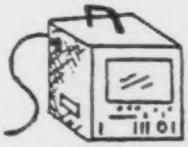




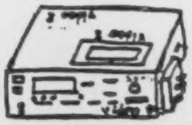
Little 8mm. Camera



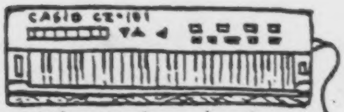
8 mm Zoom Camera and adapter



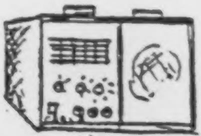
Small TV and Cable



Small VCR and adapter

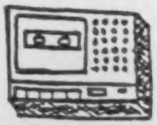


CASIO Keyboard and cable

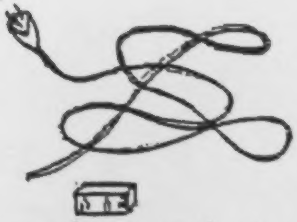


CASIO speaker

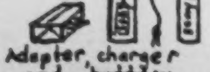
Headphones



Small cassette recorder



Extension cord and adapter plug



Adapter, charger and battery

START A MULTI-MEDIA CLASSROOM IN YOUR SCHOOL

By Fred D'Ignazio

"One day at lunch our music teacher Pam Moore casually mentioned a workshop in computers, so we all decided that we would sign up for it. One of the teachers had seen Fred on the TV, and she said he was a very knowledgeable person. That was the beginning of the most unbelievable year I've ever had in teaching."

--Sandra Pilley, 3rd Grade Teacher, Hewitt Elementary

The Multi-Media Sandbox

I conducted my teacher workshops in Canada in April 1986 and in Alabama in the summer and fall of 1986. The theme of my workshops was "The Multi-Media Sandbox." I've described the sandbox workshops in my column in Compute! (September 1986 and February 1987) and Compute!'s Gazette (November 1986 and February 1987).

The spirit in my sandbox workshops was one of playfulness and fun. According to Sandra Pilley: "The moment we arrived we just dove right in. Computers everywhere! I loved it. Each of us got to explore our own area of interest. We videotaped each other, printed signs, worked on a new program for word processing called Magic Slate, and began to learn Fantavision. We played and really got into the groove. It seemed that the three days just vanished! We were delighted when we were called back for Round Two. It was here that we learned how to film, edit, and put music to a movie. The potential of using this new technology to feed a child's imagination and watch it grow was more than enough to make us all explore and learn more."

The Indian Boogie-Woogie

When the Hewitt teachers returned to their classrooms in the fall of 1986, they carried the sandbox spirit with them. Third-grade teacher Chiquita Marbury demonstrated video cameras to her children by taking them out to the school playground and having one of them film her sitting in a sandbox, tossing sand up in the air, and telling her viewers that sandboxes are fun places to learn, "so come on in!"

Sandra Pilley and fellow third-grade teacher Susan Busenlehner found a grocery cart in the school cafeteria and created a video of Sandra pushing the cart through the halls saying, "Boy! I have pushed my way through a lot of stuff. It's been wild! But now I'm ready to bring multi-media to you!"

The three sandbox graduates recruited four more teachers. Together they became known as the Multi-Media Seven or, simply, the "media maniacs." In early November during a team-teaching unit on Indians, the seven teachers got up, impromptu, and, while a third-grader caught them on video, they did "The Indian Boogie-Woogie" in front of 200 startled third and fourth graders. According to Sandra: "Here we were dancing in front of all these children and imitating them. We were wiggling in places they didn't! They were hysterical. The point is, with multi-media even your inhibitions are eradicated and the real you MUST come out. Just ask those 200 kids."

Not satisfied with taking the sandbox to school, the teachers also took it home where they held all-night multi-media parties to prepare for upcoming multi-media lessons on sentence prefixes, math word problems, creative writing, and China. The teachers' houses overflowed with computers, printers, modems, electronic keyboards, VCRs, and monitors. Cables were everywhere. On the walls the teachers taped directions to the equipment. They were constantly on the phone -- calling a local teenager for advice on a computer graphics program, the school music teacher for the musical notes in "Ten Little Indians, even the local radio station so they would play a song the teachers could record on cassette for one of their lessons.

Eighty-Seven Kids!

How did the students react to all these high-tech hijinks? The teachers found out when they announced that Hewitt Elementary School would be hosting a media club for third and fourth graders (the school stops at the fourth grade). The teachers showed up at the school auditorium early one morning expecting five or ten children. They were shocked to find eighty-seven enthusiastic students filling the bleachers. After the teachers recovered, they divided the media club into four sections: the Desktop Publishing team, the Sound team, the Video team, and the Computer Art team.

The media kids became a school-wide resource. It was a common sight to see them rushing around Hewitt like a high-tech rescue team. When a media kid visited a new room, a teacher got to see firsthand what the "media maniac" teachers were up to. Before long, teachers all over the school were asking Sandra and the other teachers if they could join their group.

From Sandbox to Studio

The sandbox appealed powerfully to the teachers' imaginations. But to kindle the students' imaginations the teachers created a new metaphor, the *studio*. Student producers in a classroom "studio" took over a lot of responsibility for their own learning. Now they had to listen carefully when the executive producer (the teacher) taught them new subjects. They had to organize the new material in their mind and plan how they would communicate it to other students, to their parents, and back to the teacher.

To communicate what they'd learned, the students had lots of options -- both in terms of equipment and production format. They could create a "Science Radio" program using a boom box, a keyboard synthesizer, and a microphone. They could print up a student newspaper, as Hewitt students did, called "The Greek Gazette," filled with stories drawn from Greek mythology, each ending with a student's own byline. They could make a "do-it-yourself" video which walked other students through a math word problem, a science experiment, or a list of state capitals. Or they might create a computer animation of a black hole, as one student did.

An Apple IIe computer was the hub of the multi-media center which Hewitt teachers set up on three little AV carts from The Highsmith Company. The two-foot-high wheeled carts were pushed around the school, from classroom to classroom, even by kindergartners. Students used the Apple in desktop publishing activities, to make computer art to illustrate their homemade books, to create title and credit screens in their videos, and to create computer music to accompany their video and audio productions.

In addition, teachers at Hewitt plugged their Apple into an Apple Personal Modem and a telephone line and connected their multi-media classroom to other multi-media classrooms scattered across Jefferson County, Alabama. Dr. Ron Jones, Director of Staff Development for the county, had set up a teacher's bulletin board so teachers could share their successes, troubleshoot their problems, and keep up with new training workshops, multi-media events, and news about discount prices for videotapes, diskettes, printer ribbons, etc.

Hewitt teachers also joined the Imagination Network, a computer link between Alabama multi-media schools and 13 multi-media schools in the Saanich School District in British Columbia, Canada. It was an opportunity for students in both countries to exchange "computer penpal" letters online, submit stories for classroom newspapers, and report on local culture, geography, and events for lessons being taught on the opposite side of the continent. Also, according to Hewitt special-ed teacher Lynn Murphy, it was exciting to be so closely in touch with other teachers: "Teachers feel so isolated," she said. "They work alone in their classroom and rarely get the chance to work with other teachers. Now we've got a 'classroom without walls.' Any time I want I can sit down at the computer and be in touch with dozens of other teachers. I can learn about what they're doing, and they're welcome to borrow my ideas and try them out in their classrooms. Best of all, I've learned that there are a lot of other teachers out there who are just as crazy as I am."

Hello, Mr. H!

Teachers and their student producers organized skits built around daily lessons - pronouns, multiplication and division, prefixes, fall foliage, Pilgrims and Indians, community helpers, etc. Then they either videotaped the skits or turned them into radio programs or newspapers. Sometimes they used only one or two pieces of equipment; other times they used the entire multi-media center.

Allowing students to become producers of their own lessons gave them great power but also a great sense of responsibility. For example, Nancy Rentschler, Hewitt's teacher for children with speech impediments, organized a video lesson around letter sounds. According to Nancy: "Making the movie was fun but hectic. We had two days to put it all together. We used kindergarten children to act out one of their letter people and also used them to film the movie. Our star -- Mr. H -- was very good, but our cameraman and director really took his job seriously. He would tell the others to do things over and over again. I thought I was the director but this child took over."

Watching Imaginations Grow

Hewitt teacher Sandra Pilley said the multi-media center enabled her to concentrate on a vital skill she saw her children losing: The ability to imagine. According to Sandra: "I watched my class's imaginations grow from just repeating something they had seen on television into something new and genuine that they created themselves. We wrote and produced Video Book Reports using synthesizers, keyboards, stick puppets, and Dazzle Draw for the puppets' background. We published our own books from stories that we wrote on our own. My class would NOT handwrite their stories. Instead they slowly and diligently typed each word with 20-column Magic Slate. They came up with the idea of using the greeting card option in the Print Shop to produce book jacket designs to cut and paste on the front of the cover and on the title page. Some even used Dazzle Draw to illustrate their books with."

A professor from Oakland University in Rochester, Michigan, came to Alabama and conducted a study on the educational results of the multi-media approach. The report listed two benefits reported by all multi-media teachers: (1) A significant improvement in their students' oral and written communication skills; and (2) Noticeable improvement in students' self-image. According to Sandra Pilley: "Our oral communication skills grew immeasurably. We viewed ourselves doing skits for the whole school, giving lessons to other classes on various subjects that we had researched, and for fun we wrote and designed a fictitious product that we filmed a TV commercial on. It was hilarious! The same children that were so very insecure at the beginning of the year became the biggest hams under the sun."

Hewitt teacher Susan Busenlehner agreed: "I'm always on the lookout for methods that let children find and express their special talents. Composing music, using their voice, creating original artwork, dramatizing, expressing their feelings, writing, directing, care of equipment for mechanically inclined students -- it's all there in the multi-media center. Success is so important to children. It encourages other successes and I didn't see a single child or teacher who didn't feel a certain pride of success in some aspect of multi-media."

Six Giggling Moms

The teachers' and students' enthusiasm for multi-media overflowed into other classes and even found its way into students' homes. Parents who showed up at open houses and parent-teacher conferences remarked that they had never seen their children so eager to leave for school each morning. "Whatever it is you're doing," said one parent, "keep it up!"

Parents' involvement also took more substantial forms. When teachers appealed to the PTA for new equipment and supplies, carloads of material arrived from home. Parents loaned and donated old video cameras, cassette players, VCRs, electronic keyboards, TV sets, printers, modems, and computer paper.

Parents also began showing up in the classroom as multi-media helpers. According to one teacher: "We even had a dad make us a 'clacker' that I painted black and white. We used it to announce to the camera crew that a 'take' was ready. You could hear them clack the boards together and say, 'Science News on the Air, take 2!'"

Teachers who used to scramble to get one or two parents to help were suddenly overwhelmed by parent volunteers. Sandra Pilley's experience was typical: "I asked my head room mother if she would call and see if there would be any of this year's Moms that could come to school and do various things. She said that on Thursday there would be a Mom to come and work on the computer. On Thursday, I heard a real buzz coming from the back of the Teacher's station. When I looked back there, there were six giggling Moms all trying to use the Print Shop."

Three Keys to Success

Hewitt teachers learned that there were three keys to success with multi-media. First, keep it simple. Second, do it your way. And third, be a maniac.

First, keep it simple. Hewitt teachers learned not to strive for perfection in their productions. They weren't professional TV producers, so they didn't try to act like them. The whole purpose of multi-media was for a teacher to have fun and to help her kids learn. The emphasis was on <process> not <product>.

Second, do it your way. Each Hewitt teacher found that she had to find her own doorway into multi-media. If a teacher had already used a cassette player, then that became the starting point for her first multi-media activity. Or if she was interested in video or computer word processing, then she started there. Teachers learned they couldn't do everything at once. They tried one thing at a time and built on their successes.

Third, be a maniac. Hewitt teachers learned early that if they didn't concentrate on their own enjoyment and satisfaction, then they lost the sandbox spirit. In Multi-Media, teachers had to come first. It was important for teachers to relax and have fun playing with the equipment, or, like teaching itself, it was not worth the hassles and extra work.

Roller Skating and M&M's

Hewitt teachers got their equipment from parents, local businesses, and fund-raising. When Hewitt parents saw the value of multi-media they became big providers. Local businesses, too, became a big resource. Hewitt classes "adopted" several local Birmingham-area businesses. They publicized the businesses' products, and students designed cards, flyers, banners, and videos describing all the things their classes could do with multi-media. The businesses responded with surprising generosity. Video Showcase donated blank videotapes and loaned video cameras. Village Computers donated computer paper, printer ribbons, and diskettes. Radio Shack loaned TV monitors, Walkmen, and boom boxes. M&S Electronics repaired the school's equipment at cost.

When a school can't beg or borrow something, it turns to fund raising. Teachers know all about fund raising. At Hewitt, teachers built a giant cardboard box of M&M's, and a student walked around the school inside the box calling out, "M&M's for Multi-Media!" The multi-media teachers and their students wound up selling hundreds of dollars of M&M's. Of course, if the truth be known, many of the boxes were purchased by the multi-media teachers themselves. As one teacher said, "When I looked in the mirror after that campaign I knew what a sacrifice I had made for multi-media." And, according to a student newsletter made with the Newsroom: "Every Friday my mom and I went and sold M&M's around the school. They were $1.00 a box. Our best customers were the teachers. Teachers get hungry during the day, and they usually eat a lot (as the picture shows), but now they ate all the time. They owed the school money and they gained weight."

Sacrifices for multi-media didn't stop with a few extra pounds. Sometimes teachers put life and limb in peril as well. According to Nancy Rentscher: "There were many nights at the skating rink to earn money for repairs and new equipment. I skated one night for the first time since sixth grade. By the end of the night I could go forward pretty well but I never did learn how to stop. Only for multi-media would I nearly break my neck."

Insects on Parade

Hewitt teachers converted an old book storage closet into their multi-media room. Each night the carts were wheeled into the closet and the door locked. According to Sandra Pilley: "We had to go through a kindergarten class to get to the closet which we nicknamed the 'Olin Mills Studio.' One day Dr. Solomon, our principal, was leading a group of dignitaries on tour of our school, and all these strange kids kept coming out of the book closet. They were dressed up like insects. Ms. Marbury's third grade was filming "Insects on Parade," and they paraded right into the visitors. We nearly died, but we shouldn't have worried, because Dr. Solomon thought it was a wonderful place and a really neat idea. Talk about teaching kids about metamorphosis. They changed from kids to insects to camera crew all in one day!"

Multi-Media on a Shoestring

Recently a group of eminent professors visited Hewitt Elementary and the other twelve Alabama multi-media schools as part of a congressional study on the use of technology in education. The professors had visited some of the top projects in the country, but they concluded: "The multi-media effort in Jefferson County had the lowest per capita expenditure in the case study ... It operated on a shoestring. And yet in terms of excitement, and in our judgment, impact, it was among the top two or three projects reviewed for this study."

The study went on to state: "It is impossible to convey on paper the excitement generated among the public, the administrators of the schools involved, the teachers, and the students ... All agreed, and our observations would strongly support their assessment, that the project was a success beyond their wildest dreams, that it had produced significant learning outcomes among the students and teachers, and that it truly led to an integrated use of technologies throughout the curriculum."

A Final Word

Hewitt teachers used multi-media in five ways: (1) As a means to enliven the teaching of dry or difficult subjects, like parts of speech, letter writing, and math word problems; (2) As a way to reach special children who were hard to teach; (3) As an enrichment activity for students to do on their own; (4) As an enrichment activity for the entire class; and (5) As an incentive to get students to complete their regular assignments.

Teachers who reported using multi-media as an incentive talked about amazing results. According to one teacher: "Getting the kids through some units used to be like pulling teeth. But this year, all I had to say was, 'As soon as you're done, we'll do multi-media.' Units that used to take two or three weeks were completed in a matter of days. I've never seen anything like it."

At the end of the year all the Hewitt teachers agreed that multi-media had been a challenge, but it contained many rewards for a teacher who was looking for something new for herself and her students. According to Sandra Pilley: "I would strongly recommend that any teacher who is looking for a way to plug her children into tomorrow's high-tech world *today* pursue multi-media, because the assets far outweigh the disadvantages. I have always believed that good teachers were people who stretched themselves. What better way than to stretch all the way into tomorrow and have a real effect on tomorrow's people."

For More Information

If you are interested in starting a multi-media classroom in your school, write:

Fred D'Ignazio
Multi-Media Classrooms
1302 Beech Street
East Lansing, MI 48823

I am putting together a multi-media classrooms *Starter Kit* which will help you take your first steps into multi-media. The material in the kit comes from the teachers at Hewitt Elementary and their colleagues at 25 other U.S. and Canadian multi-media schools. The kit has a teacher-training video; a video of teachers and students doing multi-media lessons in the classroom; and an audio cassette with lessons using music and sound. There are also dozens of student activity sheets, lesson plans, and student producer notebooks.

It's the Mentality, It's Not the Money

ONE ALABAMA SCHOOL ORDERS MULTIMEDIA A LA CARTE!

Fred D'Ignazio

"There's always one more thing we're working on", says Norma Bumpus, assistant principal at Cahaba Heights Community School. "Last year, it was eggs dropped from helicopters, this year it's multimedia. Next year we'll be building an amphitheater."

This search for new projects and new ways to help kids tells most of the story about Cahaba Heights, an elementary school near Birmingham, Alabama, that has discovered how technology can serve its teachers and students—without costing a fortune.

But what could fill an inexpensive multimedia center? Reheated 60s hype? Hardly. Few, if any, of the components in Cahaba's design were available to most teachers 20 years ago. What the school has done is reorganize the separate tools of technology—computers, synthesizers, modems, printers, video cameras, audio cassette recorders, radios—to make them powerful teaching aids.

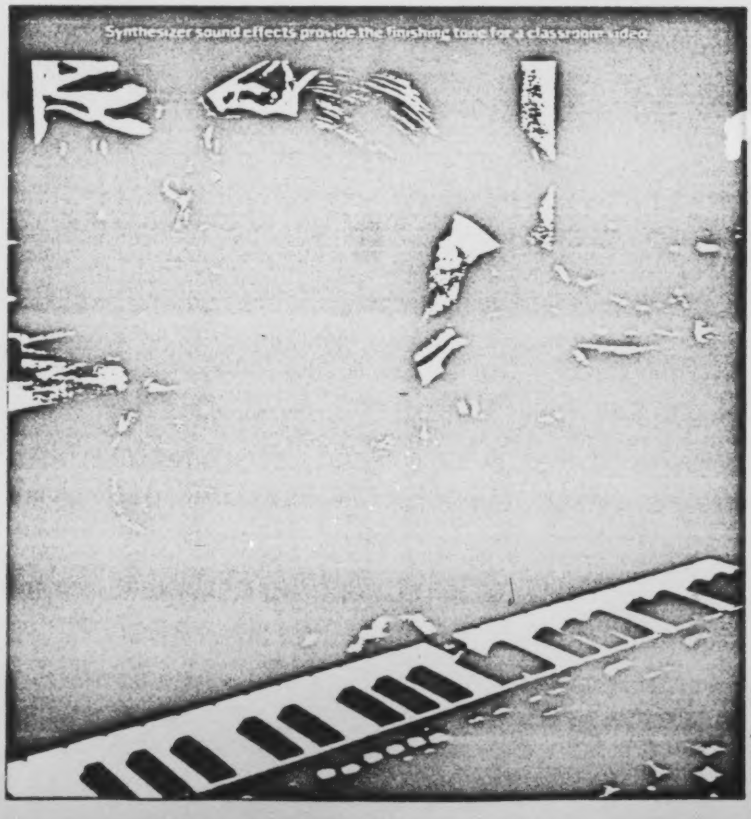
Mind over money matters

Unlike other schools that mortgage their technological options by purchasing budget-busting programs, Cahaba's staff has developed a multimedia center that is surprisingly within financial reach. I worked with the staff to help them achieve this, in preparation for a series of technology workshops I was to give at the school.

First, we considered a prototype multimedia center. But was it expensive! We were talking about $2,000 electronic keyboards, reverbs, drum machines, special-effects generators, and laser printers. Not only was the equipment too costly, it was too big for kids to handle.

So we started scaling down. Soon we had a multimedia center loaded with goodies, but built from items any teacher could find in school or with a little scavenging.

Cahaba's multimedia center rides on three two-foot-high, wheeled carts. One cart is the Video Center, which includes a VCR, camcorder, and small TV. Another cart is the Audio Center, with a boom box, an electronic keyboard, a six-outlet power strip, a box of video tapes,


Synthesizer sound effects provide the finishing tone for a classroom video

Photos by Mark Gooch

and a box of audio tapes. The third cart, the Desktop Publishing and Telecommunications Center, holds the computer, modem, printer, and paper supply. With these low-cost devices—only the computer costs over $100—students and teachers can create their own wire service, and exchange pictures and news stories just like the big kids at Associated Press, United Press International, and USA TODAY.

The spark

I began my workshop series with no idea of what giant strides technology would take at Cahaba Heights. I didn't realize then how lucky I was to work with a principal like Rick Lazenby. He's an enthusiastic advocate for his school and a vital support for his teachers. According to Lazenby, "Teachers at Cahaba Heights are high fliers. They aren't afraid to try new things." Lazenby credits this positive climate to the focus on students—not just the top guns, but all kids. "We're a student-centered school", he says. "That's different from being principal-centered, teacher-centered, or convenience-centered."

The effects of this attitude are in evidence in the halls and classrooms of Cahaba Heights. In Janie Beale's science class, teams of children design a special science textbook featuring the classroom pet—a 14-foot python. Dennis Goldsmith's fifth graders work with kindergartners, typing the younger kids' stories into the computer. And in the school office, a dozen kindergarten boys and girls interview Lazenby for a classroom video. Says Lazenby, "Like a family, school is a place where you can say what's on your mind, and others listen. It's important to offer children a place for them to communicate."

The Imagination Network

A place to communicate. That's one mark of an effective school, and it's the essence of a multimedia classroom. To increase kids' desire to communicate, we created the *Imagination Network*. Here's how the project came about.

Through a fortunate coincidence in scheduling, I was invited to Victoria, British Columbia, to present a workshop series similar to the program at Cahaba Heights. As a result, 13 Canadian schools became multimedia twins to 13 schools in Alabama. Now they can send each other videotapes, computer-generated newsletters, and audiotapes through a network sponsored by Simon Fraser University in Vancouver.

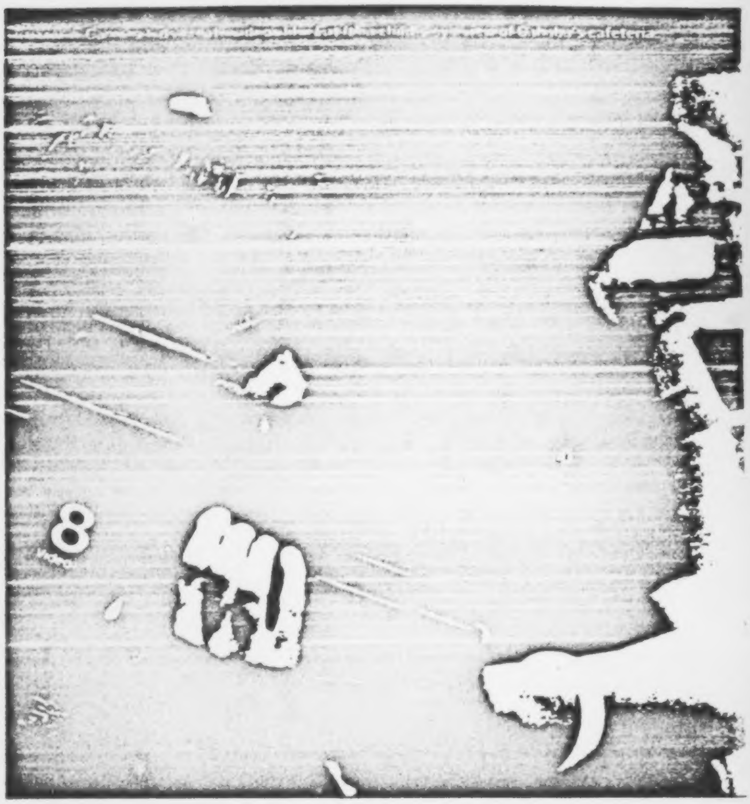
Once on-line, schools may choose from any of the Network's services:

○ **The International Network** This program enables kids in Alabama and in Canada to become computer pen pals and send each other electronic mailbags filled with letters, newspapers, pictures, and reports.

○ **Dr. J's Bulletin Board** This electronic bulletin board, set up by Dr. Ron Jones, staff development director for Jefferson County, Alabama, Schools, makes it possible for local teachers to post messages and to read technical and administrative memos.

○ **School-to-School** In this program all kids have to do is simply press a button and their computer dials another school's computer. Students and teachers can hold a live teleconference and type messages to each other.

The Imagination Network's programs are easy to learn; and all we need are a modem, a telephone, and a computer! We call the Network "the classroom without walls." When computers hook up, it's as if the classroom walls come tumbling down, and thousands of miles shrink to nothing. Canadian students send stories of what it's like to live on Vancouver Island. Kids at Cahaba Heights send tales about life in the heart of Dixie, about 'Bama football, storytelling on the Selma riverfront, and Mardi Gras celebrations in Mobile. The Imagination Network is a two-way, multimedia highway, where distance is only a state of mind.



A healthy school climate

Technology spread through Cahaba Heights naturally. But that's not to say it was inevitable. It was helped along by teachers who believe that technology is an effective way to motivate children and to help them learn more, faster. And students aren't the only ones who benefit. Said one teacher, "I still have the same workload, but since I see success happening all around me, I'm recharged. I put in extra time, but it doesn't feel like work. It feels like treating myself to dessert."

By the end of the 1986-87 school year, Cahaba's teachers had designed dozens of multimedia lessons in math, science, language arts, and social studies. For example, fourth graders in Barbara Durrett's class created a movie about dinosaurs, using computer graphics for their title and credits and a keyboard for sound effects. Other students completed a unit on advertising in which they created video and print ads.

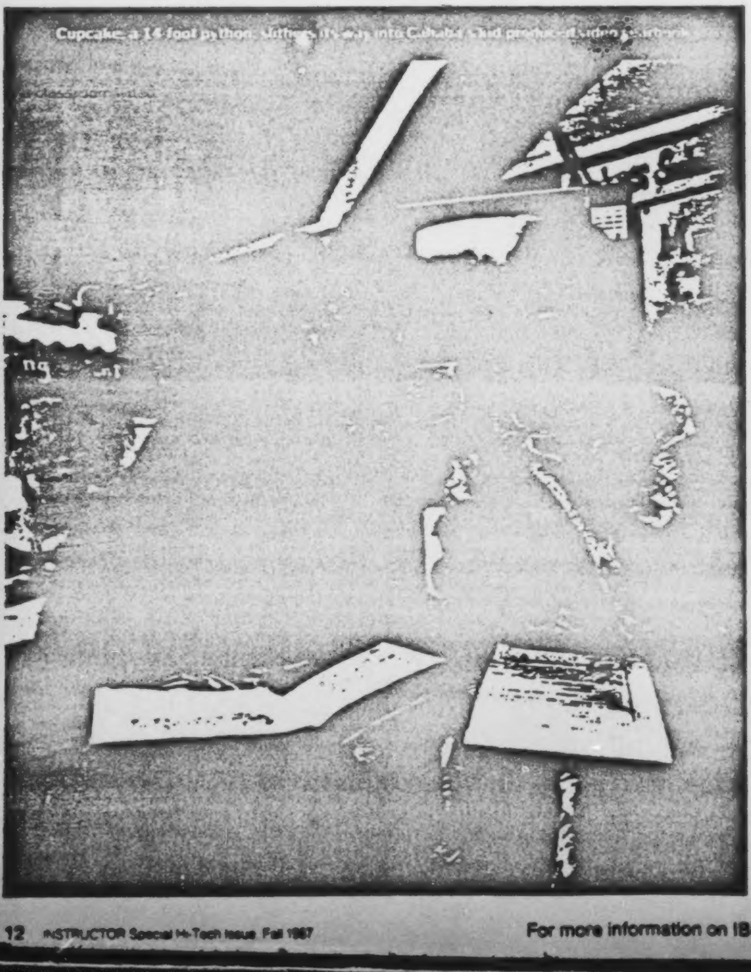
Then when Janie Beale's sixth-grade students created the school's first electronic yearbook, it became an instant video hit! Children from other classes brought in blank cassettes, eager to get their own copies.

Media fans

What convinced teachers at Cahaba Heights to get involved with a multimedia program? Kids, of course. Teachers may have hesitated, but students wouldn't allow them to remain on the technological sidelines. Under the guidance of teacher Dennis Goldsmith, gung-ho kids formed a school-wide media club. Individual classes chose interested students to be on media committees, to learn how to use the technology. Once experienced with the equipment, these students returned to their classes and trained other kids. The process soon had a life of its own. Sixth graders were loaned to kindergarten classes, fourth graders collaborated with second graders, and their teachers were invited along for the ride.

Technology is everywhere at Cahaba Heights, and yet it isn't obtrusive. It took off, but it never took over. It fit right in and never distracted attention from each day's main event—educating children.

Fred D'Ignazio is a contributing editor for *Compute!* magazine. During the 1986-87 school year, he presented workshops on the use of technology in schools in Jefferson County, Alabama, and in the Saanich school district of Victoria, British Columbia.


Cupcake, a 14-foot python, slithers its way into Cahaba's kid-produced video yearbook

> "Teachers at Cahaba Heights are high-fliers. They aren't afraid to try new things. We're a student-oriented school."

For more information on IBM, circle number 107 on Reader Inquiry Card —

In Nation

Cahaba Heights Model For Multimedia Classes

By Mara Jambor*

Editor's Note: The students at Cahaba Heights Elementary School in Jefferson County are at the center of change in the way lessons are taught and children learn, since their school is the model for the system's 13-school pilot project for multi-media classrooms.

Change was mandated by the Carnegie Report on Education in the United States, which said that the educational system "must be rebuilt to match the drastic change needed in our economy if we are to prepare our children for productive lives in the 21st century."

At Cahaba Heights Community School, a pilot program of "multimedia classrooms" has been created. In these classrooms students are involved with hands-on experiences with a variety of multimedia equipment:

- In one corner of the classroom, students are videotaping each other's presentation of *All About Me* cinquains.
- Elsewhere, another student is working with a tape recorder, trying to choose appropriate background music to dub over his video.
- Yet another child is at the synthesizer, creating her own sound effects to dramatize her brief stanza about herself.
- The screen of the Apple computer changes as a sketch of a schoolhouse breaks apart and reassembles to spell a young author's name.

The room is literally alive with interest, excitement and commitment from 31 fourth-graders who are "turned on to learning."

In the cafeteria, amid the jumble of children carrying trays full of food, a kindergartener armed with a Sony miniature video camera films a five-year-old's view of his place in the lunch line. What next? High tech has even invaded kindergarten—and has been welcomed with open arms.

Multimedia Cart

The concept of the multimedia classroom focuses on the shared use of limited resources, in this case a multimedia cart supplied with a computer, monitor, printer, video camera, video cassette recorder, synthesizer, speaker and a multitude of cables, cords and adapters.

One teacher is assigned as a multimedia coordinator. It is the coordinator's job to arrange a schedule that will allow the teachers to have access to the multimedia cart when they need it.

Teachers are able to enrich their normal lesson plans because they know that the equipment will be available to them and will add an extra dimension to their teaching. The use of the video camera enables a teacher to reach beyond the four walls of the classroom and capture a special moment like one would take a net to capture an elusive butterfly.

Initally, the multimedia teachers offered a support system for each other. Some had more expertise with computer skills, other with the video cameras, and so on. However, once the equipment was put into the hand of the students, the support system spread to include them and before long there were student "experts" who were being sought out by the teachers. In general though, the skill levels went from the top down. That is, the teachers trained a few o the most able, older students, who the trained others, who then trained younge ones.

Teaches Critical Thinking

Multimedia equipment in the classroo offers some unique experiences for childre in analysis and problem-solving. The ver nature of the equipment promotes acti trouble shooting. For example, when a chil turns on all of the equipment, and it doesn work, then he/she must stop to analy what he/she did and compare that to wh should have been done.

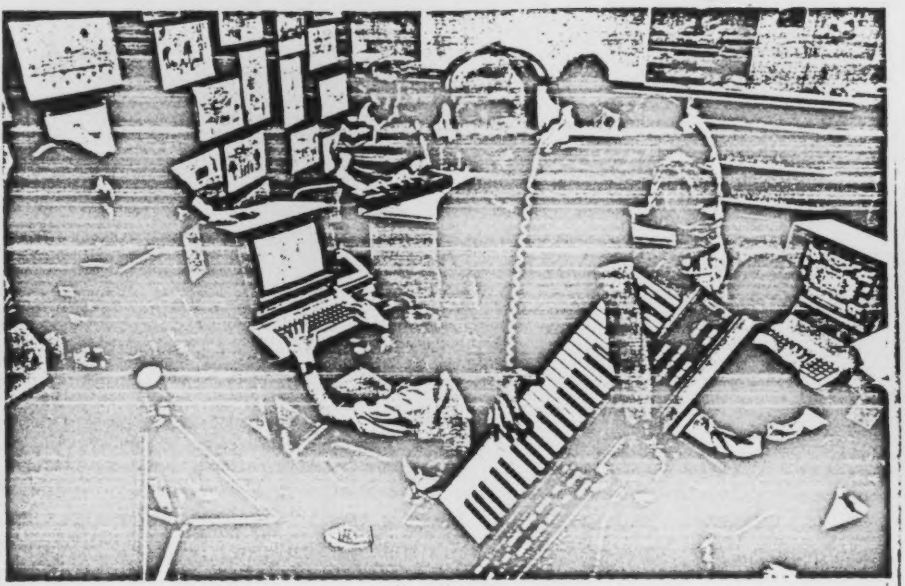
The mental exercise involved would something like this: "I pushed the ON bu ton, but did I connect the cable to the pow supply? OK. Then, if I want the picture come from this VCR to that monitor, the must plug video OUT from the VCR video IN on the monitor." It is pure logic. is simple deduction. It is analysis. It is thin ing in action! The child thinks, acts, rethin and reacts, and in the process takes anot step closer to becoming a critical thinker.

Multimedia equipment in the classro changes the student from a passive obser to an active learner. The student is not jus passive recipient of knowledge that is pour out from the instructor, but an active par ipant in the learning process.

If we are to prepare our children for 21st century, then we must prepare them be able to reason and analyze. Today's hi tech equipment is the abacus of tomorro but a child who has learned that he/she find the problem and solve it will be inventor of the high technology of the 2 century.

*(*Kindergarten teacher, Cahaba Heig Community School, Birmingham, Jeffer County Schools)*

BY SCOTCH GRAY



Multimedia Sandbox

A new multimedia classroom project is showing children how to build their own imagination network.

BY MARY JACQ TRAMMELL

Fred D'Ignazio (above) designed a program that turned 13 area classrooms into state-of-the-art media centers for kids and teachers.

Sometimes classrooms—much like sandboxes—can be the best places for kids to play. There they can excavate ideas and build mental sand castles.

That's the philosophy of Fred D'Ignazio, a high-tech magician who is turning 13 Jefferson County classrooms into multimedia sandboxes, a term he coined to refer to state-of-the-art media centers for kids and teachers.

The idea is to put electronics on wheels—carts supplied with computers, monitors, printers, video cameras, video-cassette recorders, synthesizers, speakers and cables, cords and adapters.

Students are then turned loose with the equipment to translate their ideas into video recordings, desk-top newspapers, audio productions or a combination of all three.

"Kids are not afraid in the least to press 40 buttons at a time. It's a sandbox to them. They're thinking it through, seeing what works. They don't read manuals, and they're not afraid of breaking the equipment," says D'Ignazio.

"I've written about technology for 10 or 15 years. I've become very interested in how frightened people become about using machines. What I was trying to do with the sandbox is create an environment in which we can become childlike in our approach to technology."

D'Ignazio is the author of more than 20 children's books on science and technology and is a regular columnist in *Compute!* magazine and *Compute!'s Gazette*. He appears from time to time on *Good Morning, America*, WBRC-TV's *Morning Show* and PBS's *Education Computing* and *The New Tech Times*. He also works as a consultant to the Children's Television Workshop, *Consumer Guide* and numerous other companies, school systems and publishers.

When Ron Jones, director of staff development for Jefferson County Schools, was looking for someone to conduct some computer workshops for his teachers last year, he was referred to D'Ignazio.

The computer expert, in turn, had a contract with a textbook publisher to write a teacher's guide for the multimedia classroom. He needed a group of teachers for a pilot project.

Jones and D'Ignazio decided to collaborate on some workshops last summer and fall, using a small amount of federal money Jones had set aside for computer training.

"We had small hopes compared to what developed," says D'Ignazio. He had hoped to recruit one or two schools for the pilot project. But 75 teachers attended the workshops and wanted to become part of the project.

"Without embarrassment, teachers climbed onto tables and aimed their video cameras at their classmates," says D'Ignazio, describing the workshop sessions.

"They shot irreverent closeups of my ears, knees and beard. They wrote haunted house stories on the computer and set them to music. A recent workshop ended with one teacher videotaping the rest of us holding up a computer banner that read 'All It Takes Is All You've Got.' Some of the teachers blew and popped bubbles. All of us danced together to Beethoven's Third Symphony."

The teachers who wanted to be part of the pilot project were asked to write proposals, including 10 lesson plans each. Proposals flooded in and filled a thick notebook with ideas for D'Ignazio's book. In turn, he selected 12 county schools and one Vestavia school for the pilot multimedia project.

Some of the schools already had a few of the components needed for multimedia centers, but most needed video cameras and assorted other pieces. The teachers, Jones and D'Ignazio set out to get more components through school money, ingenuity and the generosity of local and national electronic suppliers. D'Ignazio's plentiful contacts resulted in sponsorships by 18 national and seven local companies.

Today, in the 13 multimedia classroom project schools—nine of them with complete centers—children can be seen and heard using video cameras, producing strange electronic sounds, developing professional-looking printed materials, manipulating images on video screens, building their own imagination network—in short, enacting a 21st century bazaar of exotic, high-tech images and sounds.

"The rooms are literally alive with interest, excitement and commitment from [children] who are turned on to learning," says Mara Jambor, project coordinator at Cahaba Heights Community School, flagship school in the project.

"This, hopefully, opens up a new area for kids. It's teaching these kids thinking skills."

"I've been around a long time, and I have not seen such excitement generated among teachers before," says Jones.

"I just sing the praises of the teachers here. You have to have a big imagination to visualize how to use this technology when you're not familiar with it. Then you have to jump in and wrestle with cables and hardware and software," D'Ignazio says.

Janie Beale of Cahaba Heights teaches mathematics and science to sixth graders, subjects that could be considered "dry" without the use of media. Her "Rotten to the Core" science lesson was an example of a learning experience that was anything but dry.

She played symphony music mixed with insect sounds while students lay on the carpet in a darkened classroom. Tubs of foliage and rotten and decayed leaves gave an earthy odor to the room. Beale talked to the students, asking them to imagine how the earth would look if all fallen trees, leaves and dead animals stayed on the ground forever without decaying.

After this imagination lesson, the students went outside, where they observed tiny organisms, then videotaped fungi, dead plants and animals and learned about the ecosystem firsthand.

Beale hopes to add new projects to the lesson, like making a "moldarium" from various food substances such as bread, cheese and fruit and maintaining a classroom compost pile.

Beale did not start out being so at ease with high technology. "I'm terrified of equipment and machines," she says. "I just decided to get gutsy and come in on weekends and nights and learn by trial and error. I gained some independence, and I gained some guts."

Barbara Durrett, also at Cahaba Heights, began by videotaping her students narrating autobiographies, with their choice of background music. Soon they were writing poems about themselves and illustrating them with computer graphics, sending the finished products to pen pals in New York.

"I'm thrilled to see the child who in September didn't pay much attention to grammar now being almost nitpicky because his composition is going to be in print. My students are beginning to think in a more organized manner," says Chiquita Marbury of Hewitt Elementary.

Her project, entitled "The Last Warrior," mushroomed from a simple study of American Indians into a major production in which four classes adopted tribes. They dressed in costumes and staged a powwow with dances, songs and storytelling—all on videotape.

Bethnee Durham of Cahaba Heights found that her kindergarteners were intimidated by a trip to the lunchroom. She turned over the camera to three students and let them videotape the whole procedure, from lining up and getting silverware to paying, eating and putting up the trays. The unexpected result was that the teachers were treated to a kids-eye view of the lunchroom. They were able to see that, from a five-year-old's perspective, it *was* intimidating.

"Kids are raised to be good at passively receiving media," says D'Ignazio. "They don't create it. With these video carts, they see how it's really created. This, hopefully, opens up a new area for kids. Now they've been behind the camera, they've produced a sound track, they've designed a storyboard and laid out a newsletter. It's teaching these kids thinking skills."

Working as a team, the Cahaba Heights teachers have completed a number of projects with their students, including taping a series of 60-second television spots on Christmas around the world, with costumes and props. They are working on a video yearbook for the school, and Beale has formed a sixth-grade production company entitled "Serpentine Dreams of Children Machine."

The production company began by videotaping Cupcake, the school's pet python, and expanded to taping and interpreting nightmares and fears of children, focusing on spiders, snakes and other subjects of horror. Beale describes the subject matter as "something they just wanted to get out of their systems."

"We have operated on a shoestring, but we have tried to create an environment where imaginations are not limited."

Selesta Meuse teaches orthopedically and health-impaired children at Mount Olive Elementary. She also has coordinated her school's multimedia center as part of her resource room.

"Most of the time, my kids don't get to participate. Now they are getting to do things, and they're seeing they're not all that different."

Meuse has found that she can go out and videotape objects and happenings that her students might not otherwise be able to experience, bringing them back on tape to share in the classroom.

"A big goal of this project is to bring the real world into the classroom," says D'Ignazio. "Trying to filter that world that is so rich and so exciting through a textbook or an occasional speaker is just diluting it too much.

"It's amazing what you can find just in the schoolyard to videotape. Then you can come back, rewind it and show it right away. And it can be saved and reused."

Vasha Rosenblum, a teacher at Leeds Elementary, had been teaching for seven years when she joined the project. "It was time to learn something new," she says. "Teachers are often caught behind what's going on in the real world."

She sees the program as "just the chance for these kids to really be involved through the senses and the local thinking process."

"I have five senses, my feelings and my imagination," says D'Ignazio. "If I'm just reading a dry textbook, how much am I using my God-given abilities to learn about the world?"

The students have become so interested in the project that they have formed media clubs and have toured television stations to learn more. They have become historians, chronicling the daily life and special events of the schools. Using computers, the 13 Alabama schools have formed an electronic link with 13 schools in Saanich, Victoria, British Columbia. They exchange "video letters," lessons and media experiences.

In the process, they are developing positive self-images, says D'Ignazio. "You're used to seeing Stevie Wonder or Ronald Reagan on the television screen, and all of a sudden, you're there—and you're only four years old!"

"The media are often seen as magnets that draw children away from language skills," says Gloria Soloman, principal of Hewitt Elementary.

"We want to use the media to strengthen and stimulate language skills. And it's working. I'm astounded by this project. It's incredible. It's beyond belief what these teachers have done. I have tremendous respect for them. They're very special teachers."

Although D'Ignazio's role as facilitator of the project for the schools is temporary, he hopes the Multimedia Classroom Project will be self-sustaining.

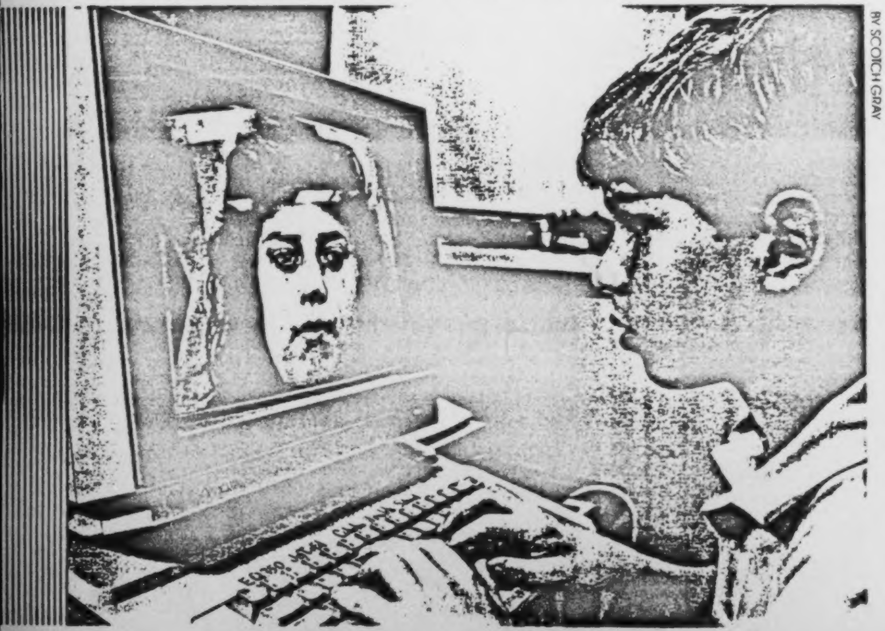
"We have operated on a shoestring, but we have tried to create an environment where imaginations are not limited. The resources are there. Once people see how these things fit together, they can do it themselves and get other schools interested and involved. These schools will become trainer schools and will move beyond themselves."

"We've broken down some barriers and shown these are tools that can be used to make teaching a lot more exciting," says Jones. "If we don't do that in the public schools, we're going to be less attractive to kids. The challenge in public education is to compete for kids' attention. We've reached a point where we can't teach children the way we've been teaching them—by dispensing facts."

One day Joey, Jeff and I went hunting in Dead Man's Forest. We found a house and Joey said, "Let's all go in." I said, "Let's all go in or never go out of the forest." So we went in it and it had spider webs. But we knocked them off. We went in this room. It was strange. I said, "Wow!" There was so much to see. There were keyboards, computer, printers, video cameras and VCRs, and tape recorders. Something scared us and we wanted to leave. But we took the media center with us!"

—Blake Boland
Student
Hewitt
Elementary
(Composed and illustrated on computer.)

Students using the new equipment can turn fellow students' television images (below) into computer-generated art at the touch of a key.



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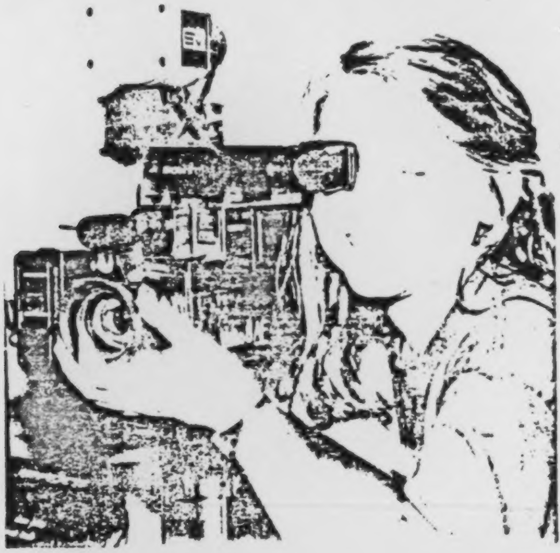

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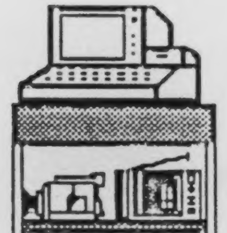

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Author

Workshop Leader

Fred D'Ignazio is the author of over twenty books on science and technology, including Katie and the Computer (Creative Computing Press; 1981), The New Astronomy (Franklin Watts, 1983), and The Parents and Teachers Guide to Using Computers with Young Children (Compute! Books, 1984). Fred has been a columnist and Associate Editor of Compute! Magazine since 1982. He has appeared as a commentator on such shows as ABC-TV's Good Morning America, Discovery Cable's New Tech Times, and PBS's Educational Computing.

Fred is working with Apple Computer, Inc. to develop a multi-media curriculum for Apple's Classrooms of Tomorrow. In addition, school districts in seven states and two Canadian provinces have adopted multi-media programs in which student "producers" use computers, video cameras, and musical keyboards to create classroom presentations in science, language arts, and other subjects.

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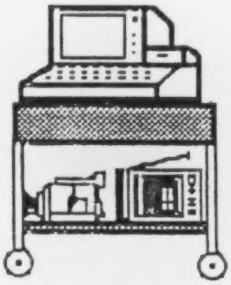

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APPENDIX B

Albuquerque Public Schools, Computer Education Pilot Project Summary, 1983-86

Computer Education Pilot Project Summary
1983-86

The computer education pilot project was initiated in the Albuquerque Public Schools (APS) during the 1983-84 school year after the approval of a bond issue in a city-wide election. The purpose of the pilot was to implement computer education in APS over a period of three years, experimenting with instructional approaches in the pilot sites before expanding the program to the remainder of schools in APS. Twenty-six pilot sites were selected on the basis of proposals made by the principal and staff at individual schools. These schools represented three components of the computer education program: general education, special education, and occupational education. This report will summarize the activities of each of these components during the three years of the pilot.

General Education

The general education component of the computer pilot initially focused on teaching students the skills of computer literacy, and later explored the applications of computers in a variety of curriculum areas.

Computer Literacy

Due to the late arrival of computers and subsequent delays in installation, computer literacy activities were not begun until the spring of 1984. During the remainder of that school year and during the 1984-85 school year, students in the pilot sites were instructed in computer awareness, including uses of computers, ethics of computer use, and proper use of computer hardware. In addition, students were exposed to three applications of computers. These included a graphics programming language, a data management system, and a word processing program.

Students were tested before and after instruction in computer awareness. Test results indicated that the material was learned fairly quickly by students at all levels. Two areas of concern were that boys had more prior knowledge about computers than girls, and children from more affluent neighborhoods with more home computers had more prior knowledge about computers than students from lower income neighborhoods. Initial results suggested that differences related to gender and socioeconomic background were increased by instruction, probably because students who had prior computer experience were more readily able to learn new material. However, later evidence suggested that opportunities to use computers in school eliminated the advantage of prior experience. This optimistic interpretation is tentative, however, since the appearance of students' "catching up" may have been due to the relative simplicity of the computer literacy test. Issues of equity in computer education continue to be of concern across the country (Lockheed & Mandinach, 1986; Sanders, 1985; Strausberg, 1984; Winkle & Mathews, 1982).

In addition to an assessment of students' computer literacy skills, student and teacher attitudes toward computers and computer use were assessed before the pilot began and after it had been in place for one year. Experience with computers in school had a positive effect on the attitudes of both teachers and students. Students and teachers became more interested in computers and more confident of their ability to work with computers. Teachers also perceived a much broader range of classroom applications for computers after the first year and felt problem solving activities were the most important potential application of computers in the classroom.

Computer Applications

After the initial emphasis on computer literacy at the general education sites, the focus of the computer pilot shifted in the 1984-85 school year to the integration of computer technology in the classroom curriculum. This emphasis continued throughout the remainder of the pilot.

Software Pilot. During the 1984-85 school year, software in all curriculum areas was pilot tested. The purpose of the software pilot was to assess the appropriateness of software in a variety of content areas for students of different grade levels and abilities. Software which previously had been approved by the Courseware Review for Curriculum Integration (CRCI) team was evaluated by teachers and students during the pilot. Fifty-seven of 81 pieces of software that were pilot tested were recommended by the curriculum coordinators for inclusion in the APS curriculum. The coordinators felt that involving both teachers and students in the software evaluation was a valuable, though cumbersome, procedure. Coordinators also remarked that excellent software was still largely unavailable in many of the content areas and research has substantiated this scarcity (Walker, 1983).

One aspect of the software pilot was to evaluate the instructional impact of the use of software in a specific content area. The area selected was chemistry. Two teachers at different high schools used computer software with one of their chemistry classes and regular materials with a second class. In both the experimental and control classrooms, the same amount of instructional time was devoted to the course, but in the experimental classes students worked in pairs for four or five class periods using chemistry software. Posttest scores of students using the chemistry software were significantly higher than posttest scores of students in the control classrooms. The teachers found the software to be a promising supplement to conventional instruction.

LOGO and Spatial Visualization Skills. During the second year of the computer pilot, the 1984-85 school year, the relationship between the use of LOGO and children's spatial visualization and problem solving skills was explored. Following the development of a test to measure spatial visualization, children in grades two through five were pretested, given the opportunity to use LOGO, and then posttested. Control groups were tested during the same time period. Results indicated that a significant gain in spatial visualization resulted from the pilot; however, additional exploration is needed to clarify the relationships between the test, the instruction, and the improvement in spatial visualization skills. Researchers are not in agreement about the effects of LOGO on children's thinking skills (Euchner, 1983).

Chapter 1 Reading and Math. During the second and third years of the computer education pilot, and again during the 1986-87 school year, three integrated learning systems (CCC, WICAT, and Dolphin) were utilized in nine schools to supplement the reading and/or mathematics instruction of Chapter 1 students. Initially, some of the systems were not utilized to capacity due to the lack of full-time lab operators. Subsequently, the addition of Chapter 1 aides to manage the labs increased the amount of instruction received by the students, although in 1985-86, two of the three systems were still not sufficiently utilized based on the amount of instructional time recommended by the systems' designers. However, examination of the reports of 1986-87 lab time indicates that students are receiving considerably more instruction than they have in the past.

At sites where sufficient service and supervision were provided, standardized test scores indicated improved reading and math skills for students in grades two through four. The most notable improvement in reading skills was at grades six through eight. Classroom teachers have been very positive in their assessment of the computer labs, citing as advantages of the systems the reinforcement of skills taught in the classroom, and the provision of instruction to large numbers of students.

Reading, Writing, and Problem Solving. In the final year of the pilot project, the 1985-86 school year, curriculum integration focused on the potential of the computer to enhance the development of reading, writing, and problem-solving skills of students. Special state-funding provided hardware and software for this pilot, which included three computers and one printer for each participating classroom, as well as a variety of simulation, problem-solving, and word processing software. Four elementary, two middle, and two high school teachers from the pilot schools were selected to participate. Teachers received inservice in coordinating computers with a process approach to the teaching of writing, and in the classroom use of simulation and problem solving software. In addition, the teachers met as a group with two Computer Education Resource Team (CERT) members and an evaluator throughout the pilot to brainstorm ideas and to share successful strategies.

The pilot was evaluated using a variety of methods such as interviews, surveys, test data, and activity logs. The data indicated that the literacy pilot had an impact in three major areas: classroom management and organizational strategies, classroom climate, and student learning. As a result of an increased emphasis in the pilot on peer activity and cooperative work, teachers developed new instructional strategies and classroom management techniques. Secondary teachers, especially, indicated a need to develop new strategies because prior to the pilot, they utilized small group instruction less frequently than did elementary teachers. Teachers were impressed with the motivational influence of computers and noted that because they were an especially attractive resource to students, they could be used for maintenance of classroom order and for motivation of classroom performance. Both teachers and students had very positive reactions to the pilot and students sought additional opportunities to use the computers outside of class time. For some students, using computers resulted in more positive attitudes toward the subject matter they were studying, a greater interest in school, improved confidence, and better relationships with classmates.

Students at all grade levels gained many skills in the use of computer hardware and software, and elementary students, especially, became quite adept at troubleshooting. Standardized measures of reading and problem-solving indicated that both experimental and control groups of students made gains during the pilot. Therefore, the specific effects of computers on reading and problem solving were not ascertained in this pilot. However, analysis of writing samples and teacher reports about student writing indicated that computer-generated writing was longer, more complex, and contained more accurate spelling and punctuation than handwritten text. In addition, at the upper grades, computer-generated writing demonstrated revisions that improved the meaning and increased the complexity of passages. Teachers also noted that use of word processing software had a positive effect on students' attitudes toward writing and revising. Despite some problems and frustrations, the overall effect of the literacy pilot was positive and generated a great deal of enthusiasm among students and teachers.

Special Education

The special education component of the pilot project focused on the use of computer-assisted instruction (CAI) and the prosthetic use of computers. The population of students served by the special education pilot in computer education was varied and complex.

Computer Assisted Instruction

During the 1983-84 school year, 321 students from 26 programs in three elementary schools were chosen to participate in the special education computer pilot. The purpose of the pilot was to examine the impact of CAI on specific learning tasks. The pilot site personnel used microcomputers to support special education curriculum objectives identified in the target students' Individual Educational Plans (IEPs). Students received a minimum of four weeks of computer assisted instruction in math, language arts, spelling or a combination of these areas. The brief time period of the pilot, coupled with the small numbers of students in the pilot and control groups, placed limitations on the conclusions that could be drawn. However, special education students who received CAI demonstrated instructional gains on standardized achievement tests.

The following year, students in at least seven areas of exceptionality were served. These areas included: physical impairment, learning disabilities, communication disabilities, behavior disorders, hearing impaired and deaf, multiple disabilities, and gifted. At the end of that year, follow-up testing was completed for special education students from the three pilot sites. Twenty-six students were tested in one or more of the following instructional areas: math, spelling, reading comprehension, language arts, and reading readiness. Statistically significant gains were made by students in the areas of vocabulary recognition, word comprehension, passage comprehension, and reading readiness. Small gains, which were not statistically significant, were apparent in math, spelling, and letter identification. Again, because of the small sample sizes the results were interpreted cautiously. However, they were considered sufficient evidence of the potential of CAI for children with special needs to warrant continued exploration.

Prosthetic Uses of Computers

The original special education pilot provided 20 special needs students with access to microcomputers. This was the impetus for the development of an adaptive equipment lab which provided, as one component, the loan of equipment to children with severe neuromotor disabilities. The intellectual functioning of many of these students was inhibited by severe physical impairments which limited speech and/or writing skills. Tasks which were once quite difficult or impossible for these students were accomplished easily with the adaptive equipment. For example, portable computers were provided to five students for classroom note taking. These students, who otherwise would have been unable to function outside of a sheltered environment, learned note taking skills as practice for high school placement. Home computers and word processing software assisted some students with homework.

Students with quadriplegia used microcomputers as communication devices. Active stimulation, a method which utilizes microcomputers to evoke rudimentary communication skills, was used to prepare these children to use more sophisticated computer equipment. Echo speech synthesizers and "talking software" were made available to speech and language pathologists. These computer applications enhanced diagnostic efforts and improved therapy for children with limited or non-existent verbal skills.

Expansion of Computer Use in Special Education

Currently, there are approximately 40 sites with classroom microcomputers. The staff at these sites have received training in computer-managed and computer assisted instruction. Training in other administrative and management uses of computers also has been made available to teachers. Instructional support functions of computers, such as computer managed instruction, have expanded from an initial focus on the generation of IEPs to assistance in diagnostics and diagnostic report writing. CAI also has been expanded to include drill and practice, tutorials, simulations and gaming, inquiry and dialogue, and problem solving. Training in the use of LOGO and other programming languages has been provided to some special education students.

Occupational Education

The occupational education computer pilot project incorporated microcomputers into the occupational education curriculum at nine middle schools during the 1983-84 school year. In a required eighth grade course, the "World of Business," computers were utilized to teach keyboarding and word processing skills as a supplement to conventional typing instruction on electric typewriters. The pilot sites were equipped with computers, printers, electric typewriters, and a variety of software. Students utilized a word processing program; a career information system; and software which developed keyboarding, spelling, and punctuation skills.

Based on the results of the evaluation of the first year of the pilot, a number of changes were made in the World of Business program. First, two additional printers, for a total of four at each site, were provided by the occupational education department. Second, a number of site modifications were made to facilitate the special equipment of the program. Third, the curriculum guide was revised by a core group of occupational education teachers during the 1985-86 school year. Between 1984 and 1986, the occupational education computer education program was expanded from the original nine middle school sites to include all APS middle schools. The program has now served over 5,000 students.

Site visits and teacher interviews conducted in the spring and fall of 1986 indicated that a few areas of the program still need to be addressed. At the inception of the project, the pilot teachers requested changes in the curriculum guide that would provide them with examples of how to incorporate computer hardware, software, and textbooks into the World of Business course. Although the curriculum guide has been revised and the objectives of the course changed, the guide still does not mention hardware, software, or textbooks. In addition, at two of the schools the classrooms are too small for the amount of equipment required by the program and at three schools electrical wiring is inadequate and potentially hazardous.

Future Direction of APS Computer Education Program

Other Computer Education Projects

In addition to pilot activities, a variety of other computer education projects have been implemented in the district since 1983. Computers are now being used in English, science, art, home economics, math, and drafting classes. A Laser Art Project was initiated through the joint effort of APS and the Space Center, with funding from the National Endowment for the Arts. The program provided a computer and low power laser for use in 11 elementary, middle, and high schools in the district. Student and teacher response to this project was very positive. Also, a Math and Science Pilot Project was implemented in ten high schools. Sixty computers, provided by IBM through a matching program, and appropriate software were placed at these schools as a resource for strengthening the math and science skills of students having difficulties in these courses. The effectiveness of this approach for improving math and science skills will be assessed.

The Computer Education Resource Team has directed much of its effort toward the development of computer disks that can be used by teachers to integrate word processing, data base management, and LOGO with specific content areas. Materials for math, science, social studies, and physical education have been developed for grades K through five. Similar materials will be developed for middle and high school use.

Issues that continue to be important in the district's computer education program are the placement of computers in schools and the focus of computer education.

Computer Placement

Computer placement is of prime importance in computer education. Although most schools in APS originally placed computers in lab settings, many are now placing computers in the classroom. This affects a number of areas. First, it appears from research and from the experiences of teachers in APS, that one ideal computer arrangement does not exist. Instead, lab settings tend to be best for certain kinds of activities, while placement of individual computers or several computers in one classroom are advantageous for other kinds of activities. Labs lend themselves especially well to providing instruction to students in the use of the computer or new software, or to time consuming computer applications, such as word processing. The use of mini-labs or individual computers in classrooms appears to be most successful when teachers want to integrate computers across the curriculum and have either self-contained classrooms, as in elementary schools, or small classes.

Second, placement of computers in the classroom creates a new set of problems related to site modifications (Lockheed & Mandinach, 1986). Most schools were not built with computers in mind and, consequently, have had to be modified to accommodate computers. Placing several computers in one classroom is especially problematic because of the need for multiple power outlets and because of classroom size. Adding computers and printers exacerbates the problems of overcrowding in many classrooms and sometimes creates additional distractions for students.

Third, the equitable placement of computers in schools may not be an equal distribution across grade levels or schools. In APS, the experience has been that it is much more practical and successful to integrate one computer into an elementary classroom, than it is to integrate one computer into a secondary classroom. The sheer numbers of students and length of class periods at the secondary level makes this strategy relatively difficult. In neighborhoods where children do not have access to home computers, perhaps the most equitable arrangement might be to provide more computers than in schools where children have access to home computers, or at least to make available a home loan program. Even with physical access to computers, Papert, a well-known computer educator, believes that children may not have cultural access. In other words, without positive attitudes and recognition of the importance of computers to future educational and career plans, students may not take advantage of opportunities to become proficient with computers. This is an area where schools can make significant contributions.

Focus of Computer Education

After an initial focus on computer literacy and applications of computers, the computer education program in APS concentrated on integrating computers across the curriculum. This approach has been recommended as an effective alternative to computer programming courses by Lockheed and Mandanich (1986), although nationally, elementary and secondary schools continue to devote a large proportion of their resources to teaching programming (Hassett, 1984). A thorough integration of computers across the curriculum, while an ideal long-term goal, is not yet practical according to Lockheed and Mandanich (1986). Current obstacles to curriculum integration are insufficient software, limited resources to support continuous teacher training, and insufficient numbers of computers (Lockheed & Mandinach, 1986; Walker, 1983). A recent study by Johns Hopkins University (1986) found that students in 1985 spent twice as much time using computers in school as they did in 1983, but the authors speculated that even the increased use does not take advantage of the computer's most basic benefits and falls short of the possibilities that computers hold for instruction.

APS also is exploring the use of the computer as a tool for learning as well as for teaching. Changes in instructional strategies and teaching style have been an important by-product of classroom computer use and are now the focus of inservice efforts with teachers. For example, teachers are being encouraged to use computers for independent, cooperative, and collaborative activities with students.

Walker (1983) identified several ways that computers contribute to education.

1. They make possible more active learning and are interactive.
2. They accept input from a variety of sources and display information in a variety of ways, making them especially valuable for students with special learning needs.
3. They make learning more fun, with less mental drudgery.
4. They make it possible to learn at a pace that is nearer the speed of thought.
5. They provide individually tailored learning.
6. They make possible more independent learning.
7. They make it easier to understand abstract ideas.

In addition, teachers feel computers make a substantial impact on the social organization of learning. In the Johns Hopkins study, teachers said students who used computers became more enthusiastic, helped each other more, and worked longer without direct supervision (1986). Similar results were evident in the computer literacy pilot conducted in APS during the 1985-86 school year and have been noted in other school districts as well (Merton, 1983).

Researchers who are actively studying the potential of computers in education caution that everything we know about computer education is based on just a few years of experience with only a few computers in each school (Hassett, 1984; Merton, 1983). The potential of computers in the classroom is just beginning to be tapped and there are still many unanswered questions. The three year pilot in APS has provided valuable information to facilitate the evolution of the district's computer education program. Next year, an evaluation of the computer education curriculum will answer questions about the impact of computer education across grade levels and content areas in APS.

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APPENDIX C

Selected Materials From Houston Independent School District

HISD Strategies To Improve Productivity and Contain Costs
From: HISD Department of Technology, Tech-Team.
    "The Changing Role For The Teacher"
    "Lead Teacher Network"
    "Curricular Emphasis"
    "Staff Training Assumptions"
Department of Technology Historical Matrix

This list of issues provides an overview of some of the strategies that the Houston Independent School District is using to improve productivity and contain costs.

ISSUES	STRATEGIES
1. Information Explosion • 6,000-7,000 scientific articles published daily • Data will double each year after 1990	• Higher Level Thinking Skills Software • Computer Programming Emphasis (LOGO, BASIC, Pascal) • Extensive Use of CAI • Telecommunications curriculum
2. Computer Illiteracy • Use of computers on the job has become widespread • Computer knowledge will become a basic survival skill	• Computer Literacy Curriculum • Utility Software
3. Increased Access to Computers • Growing gap between haves and have-nots • Significant portion of instruction delivered at home	• Microcomputer Implementation Plan • Computer Magnet Schools/Computer Resource Centers • Computers Can (Operation Fail-Safe/Parent Involvement Program) • CompuBuy • School of the Future at F. M. Black
4. Language Divergence • 50 different languages in HISD • Projections indicate a Hispanic majority within the decade	• ESL Software
5. Business/School Communication • Rapidly changing workplace • Business leaders need curriculum input to ensure that students are adequately prepared	• Technology Fair • School/Business Partnership Program
6. Insufficient Software for Quality Instruction • Publishers developing games for home market • No large-scale software	• TEAMS practice test and tutorial software • Volume Purchasing Agreements • HISD-Developed Software e.g., ESL, FunReader/FunWriter
7. Computer Changing Teacher's Role • Teacher must become a manager of instruction • High degree of computer literacy required	• Reorganization of the School Curriculum: Educational Scenario for the 1990's
8. Need to Upgrade Staff Expertise • Only 3% of potential teachers take even one computer course • Administrators are less prepared for new technology than teachers	• Technical Training for Various Groups (e.g., Teachers, Administrators, Curriculum Specialists) • Teacher Technologist Training Program
9. Paperwork Reduction • Free principals so they can serve as instructional leaders • General revenue decreases make administrative efficiency even more important	• Develop software for administrators where no commercial product exists • DOT-developed "templates" to speed standardized reporting • Integrated school management software avoids duplication
10. High Drop-Out Rate/Illiteracy • Some estimates place HISD's dropout rate at 44% • One-fifth of all Texans do not have essential skills	• Literacy Lifeline: multi-media senior high literacy program

From TECH-TEAM

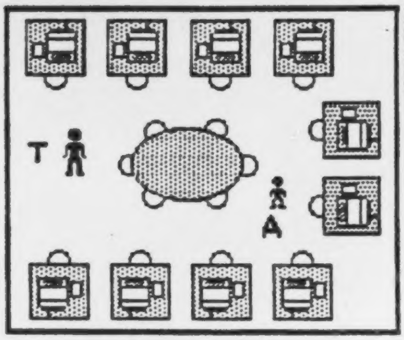
THE CHANGING ROLE FOR THE TEACHER

The Career Ladder concept should provide opportunities to train the most talented teachers to use technology. Differentiated staffing must evolve in order to reduce the labor costs involved while taking advantage of the plummeting costs of computer technology.

Highly Trained Teacher
(Teacher is Manager/Very competent)

Teacher Plus Aide

30:1



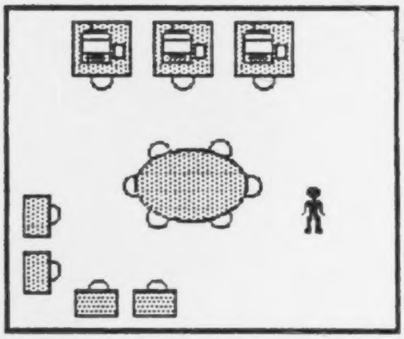
Applications / Higher-Level Thinking Skills

Modular use of computers integrated into curriculum

Content Teacher
(Regular Classroom Teacher)

Teacher Only

25:1



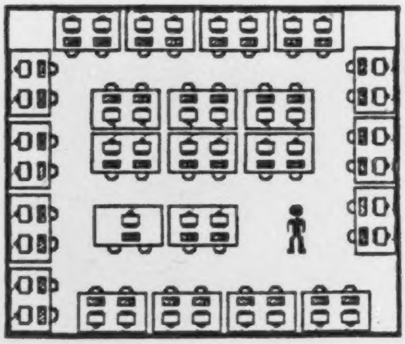
Curriculum Integration

Conventional Instruction

Lab Teacher
(Lab Environment)

Teacher or Aide

45:1



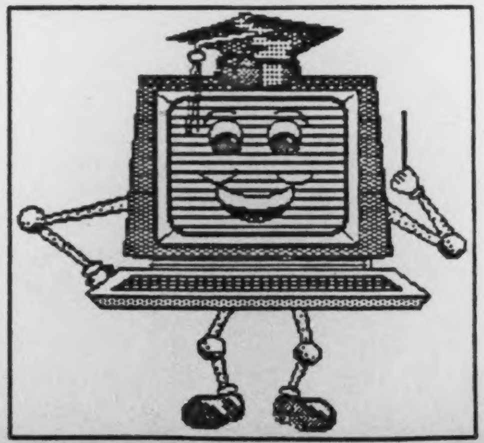
CAI

Drill and Practice/
1 computer per student

LEAD-TEACHER NETWORK

Eventually a team of Teacher Technologists will provide leadership at the campus level, and a campus computing coordinator will supply administrative leadership. The librarian will assume a new role as information specialist. This differentiated staffing plan is based on the following assumptions:

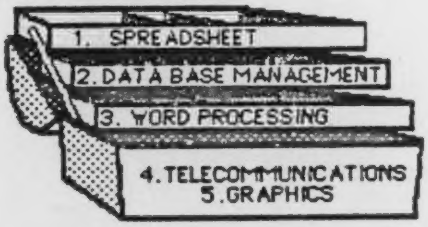
- Relatively few teachers will be highly trained in using computers.
- More flexible scheduling is desirable so that students are not limited to rigid one-hour sessions; multi-age groupings will allow students to move at their own pace.
- The expense of telecommunications access will limit students' use of data bases and information software to special classes; the most proficient and creative teachers should be assigned to these classes, since they will teach the portion of the curriculum that ensures timeliness and relevance.
- The availability of computer technology will make it possible for teachers to work with larger groups of students.
- Students will have to move to various classrooms for access to specialized equipment and teachers who are trained for the needed applications as depicted on the preceding page.



CURRICULAR EMPHASIS

	FROM	TO
TODAY:	"COMPUTER" LITERACY* -------->	INTEGRATION INTO CURRICULUM
	(isolated class-- operations-oriented-- programming emphasis)	Example: social studies will use graphics software to prepare charts/graphs illustrating demographic trends.
TOMORROW:	"TECHNOLOGY" LITERACY ---->	USE OF COMMERCIALLY AVAILABLE DATA BASES IN EDUCATION
	(applications-oriented-- emphasis on emerging technologies)	Universal skill will be word processing, not programming.
	Convergence of microcomputers and telecommunications will blur traditional lines of demarcation.	Wide-scale education utility applications Grade level and scope and sequence considerations will be less important.

TOOL KIT



* Definitions of computer literacy will change because of the rapid development of technology. Literacy requirements will vary from person to person, from job to job, and from time to time.

STAFF TRAINING ASSUMPTIONS

- Training for administrators is essential to educational reform.
- The majority of teachers do not resist computers anymore; most surveys show that teachers want computer training.
- A computer-based delivery system cannot be highly dependent upon teacher competency and ability to individualize instruction if it is to be used on a wide scale.
- The training system developed must utilize technology (computer/interactive video) in order to reduce labor intensity and staff training costs. Teachers need practical experiences in teaching with technology, so they can learn to be managers rather than lecturers.
- The use of computers at a school depends heavily on the strengths of the staff; highly trained teachers must be nurtured.
- Universities will not be prepared to respond to the teacher training needs. Most university training programs are too heavily influenced by departments of computer science; few universities have faculty members with classroom experience in the use of technology.
- Until computers become widely available, only those teachers interested in learning how to use them should be encouraged; there is no need to force uninterested teachers to use computers when equipment availability is so limited.
- Training for teachers, administrators, parents, and the community will involve not only learning to use technology tools as partners but also upgrading human instructional skills to accomplish what the information devices cannot.
- A higher professional level for at least some teachers, with concommitant increases in salary and training requirements, is needed in order to realize substantial educational improvement.

Department of Technology Historical Matrix

	81-82 (1/2 yr.)	82-83	83-84	84-85	85-86
Training	set up classroom facilities trained principals, board members, key teachers developed implementation process	designed Teacher Technologist training program started Cycle I Teacher Technologist training	designed Teacher Technologist update courses set up IBM lab and training	trained all principals on Macintosh (9 half days) set up Mac lab contingency training implemented Techmobile campus visitation program	AAT courses approved by TEA training calendar on E-Net Education and Technology Today TV series transportable training modules for Teacher Technologists
Hardware Maintenance	obsolete CCC equipment auctioned off	purchased delivery equipment and vehicles DOT assumed equipment tagging responsibilities from Prop. Mgmt.	set up electronic communications network--E-Net	cable TV network installed	trained central office staff and building principals
Software Development	none	began ESL software development	developed D.O.T.Writer word processor software	Reading courseware funded by Apple Computer, Inc. completed ESL and Activity Fund Accountant software	completed Reading courseware (FunReader and FunWriter) began literacy and testing software development $300,000 royalty income
Implementation	district technology policies and goals adopted by board Computers Can program developed for low-income families Implementation plan handbook completed	first Technology Fair CompuBuy program and Software Library established district newsletter, Technogram, began computer literacy course requirements mandated for grades 7-8	• Chapter 1 Computer Resource Centers established • developed K-12 computer curriculum and policy • CompuBuy extended • middle school Information Resource Centers installed • Tech Fair #2 • curriculum dev.when TEA ok'd H.S. comp. course options • developed Techmobile to enhance computer literacy	Apple funded School of Future proposal ($500,000 awarded) Tech Fair #3 CompuBuy extended	Tech Fair #4 CompuBuy extended created Technology Schools Co-op Lockhart Technology Academy formed
Procurement and Planning	cable TV study developed and submitted to city council computer firm specifications developed	established Software Library and software review procedure established districtwide Hardware Selection Committee; purchasing procedures adopted	first software licenses negotiated	negotiated additional software licenses	expanded software for Computer Resource Centers
Administrative Support	→	→	piloted E-Net as electronic mail system for administrators	provided Macintoshes to administrators expanded E-Net to 850 users	developed Macintosh templates for school reporting provided on-site user support for E-Net

APPENDIX D

The National Center for Learning Technologies, "Planning Document" (HISD)

The National Center for Learning Technologies

Abstract

The American educational system is besieged from within and from without. Massive adult illiteracy, falling test scores, unprecedented numbers of non-English-speaking immigrants, teacher shortages, budget shortfalls, and faltering public support spell serious trouble for our country 's future. Numerous national commissions have documented these problems and warned that if the United States' educational quality does not improve, the country will not be able to compete in the tough international marketplace being shaped by the Information Age.

America pioneered the use of computer technology for science and industry. Now the time has come to apply that technological genius to education. Abstracted below is a plan to create a National Center for Learning Technologies (NCLT) in Houston, Texas, to help transform the way Americans learn.

What Is the National Center for Learning Technologies?

The NCLT is a spin-off of the Houston Independent School District's Department of Technology. The Department of Technology has earned an international reputation for excellence in this field. According to *Electronic Learning* magazine, "Houston has emerged as a leader in the educational computing milieu. In program planning, development, and management; in hardware and software evaluation and development, Houston has set an undisputed standard." The NCLT will build on the Department of Technology's expertise to become the focal point for technology-based education in America.

Because the field is so new, relatively little research on the instructional effectiveness of technology-based education has been conducted. Neither have quality standards been developed. The NCLT will perform this necessary research. A national advisory council comprised of technology experts, educators, and government leaders will advise the organization on needed products and services. The NCLT is a non-profit corporation as specified under section 501(c)(3) of the Internal Revenue Code. It has no affiliations with computer hardware manufacturers.

What Need Will the NCLT Fill?

Commercial software developers have failed to produce research-based software for the nation's educators. They do not field test their programs in classrooms or make enhancements based on student achievement data. Rather, they have created piecemeal, stand-alone products for quick profits. This approach has yielded disappointing results for students and teachers. Such software has some value as a curriculum supplement, but it cannot compensate for the shortage of skilled teachers, especially in critical subject areas like math, science, English as a Second Language, adult literacy, and education of the gifted and talented. The NCLT will produce what commercial software developers have not--large-scale, integrated educational software. Development will be based on empirical research, not market fads.

Turn-Key Solutions

The NCLT will offer American education "turn-key" solutions. This might mean the setting up of entire technology programs, or just certain aspects of programs. The center's "turn-key" materials will combine software and all ancillary items needed to solve educational problems. For example, if the NCLT produced an instructional software package for gifted and talented students, it would also produce the teacher guides, student workbooks, and textbook correlations needed to put the software to work.

Moreover, the NCLT will deliver video material to teach use of the software in "real-life" classrooms. In other words, the NCLT will offer everything the educator needs. The material may be purchased either together or separately. This will allow maximum flexibility on the part of purchasers with a limited budget or those more technically sophisticated who do not require some of the ancillary material intended to ease implementation.

NCLT's software will enhance instruction and improve productivity for students, teachers, school administrators, and adult learners. Services to be offered include staff training, hardware and software evaluation, support for computer literacy/science instruction, and hardware acquisition. No other organization is now offering this mix of large-scale "turn-key" products and services. The NCLT will concentrate on classroom-driven products developed by educators for educators.

Language Arts

The basic skill that underlies subsequent learning is language arts. The NCLT staff already has developed a computer-based package to teach English as a Second Language. The English as a Second Language program uses recent breakthroughs in digital technology to incorporate actual human speech into instructional software. In other words, an Apple computer is able to "talk" interactively to non-English speakers. High-resolution animated graphics illustrate on-disk and workbook stories designed to teach English usage. The software has been extensively field tested. Not only do children love it, their teachers swear that it really works. It was hailed in *Education Computer News* as a "boon to school systems that offer multilingual education programs."

Another language arts program the NCLT has already completed teaches reading to students at the kindergarten through second grade levels. The K-2 Reading software also uses an Apple computer to reproduce human speech. High resolution graphics complement a series of learning games which teach vocabulary and phoneme recognition. A simple word processor includes a "talking" dictionary to build writing skills. Teachers are able to keep track of each individual student's progress with a built-in management system.

Adult Literacy

The number of adult illiterates in the United States is staggering. There are 23 million adults whose reading, writing, and comprehension skills are below the fourth grade level. Existing literacy programs, which use labor-intensive tutoring methods, are reaching less than 10% of the population in need.

Those adults who read below the fourth grade level are almost completely bypassed by existing literacy groups because they are so difficult to recruit, teach, and retain. Technology holds great promise for extending the reach of education to adults.

The NCLT has developed a high technology delivery plan for various levels of adult literacy. It calls for using computer assisted instruction to teach phonics, vocabulary development, reading comprehension, and computation skills. Building on the NCLT's existing English as a Second Language and K-2 Reading software programs, the adult software will offer color graphics, digitized human speech, and a talking word processor.

It is most important that all these instructional materials be oriented to adult interests. Older students, their self-esteem already damaged, are offended by illustrations and examples designed for children. An on-line testing and management system will assist teachers and tutors to keep records for adult students, who have an extremely high dropout/reenrollment rate. Ideally, all of a student's records could be stored on a computer database for instant access via telecommunication links. No matter where he or she studied, the teacher or tutor would know where the student left off.

The American Family In Crisis

The problem of school dropouts of course contributes directly to adult illiteracy. According to the National Education Association, one-third of all Texas students drop out before high school graduation, leaving only 10 states with a higher dropout rate. The NEA found that low levels of parental education and lack of home support for education are highly correlated with dropping out.

There is no doubt that poverty, authority conflicts, pregnancy, and learning disabilities also are contributing factors to students' problems at school. Technology cannot begin to solve these intractable problems, but it can help in ways that bring families closer together. Houston, for example, has an enormously successful program, "Computers Can," which is designed for low-income elementary school students and their families. First, parents and students are trained at their neighborhood school in how to use a portable computer and appropriate basic skills software. Then they are allowed to check the items out for use at home for several weeks. Skeptics predicted that the computers would be stolen. They were wrong. Instead, the project found that children who previously hated studying with pencil and paper would study for hours if they could sit on their parents' lap in the family kitchen or living room. "Computers Can" brought parents and children together and made parents more supportive of their children's education. An unexpected finding was that parents improved their own basic skills, as well. "Computers Can" suggests that if high-quality, attractive instruction can be delivered to homes, low-income parents and children enjoy learning together.

Studies on the diffusion of innovations have found that it is always "the best and the brightest" who adopt new technologies first. This is exactly what has happened with microcomputers in America. The wealthier schools and parents quickly recognized the significance of computers for education and made sure their children had access. The poor, as usual, have been left behind. The NCLT will place this "equity of access" issue high on its list of priorities. If the United States is not to be split into hostile camps of "haves" and "have nots," ways must be found to ensure disadvantaged children's and adults' access to the power of technology-based learning.

Choice of Product Technologies

The NCLT uses those technologies most appropriate for a particular level and subject matter. Depending on the students' age and background and the subject matter being taught, curriculum material may be developed using a combination of computer and video technology along with traditional materials. These include personal computers, videotapes, videodiscs, and the new compact discs which include CD-ROM (Compact Disc-Read Only Memory), and CD-I (Compact Disc-Interactive).

Videodiscs, compact discs, and broadcast television are all cost-effective means of reaching adults as individuals and groups. All types of technology-based instruction have a number of advantages: they ensure that only the highest quality of instruction is consistently presented; they are infinitely patient and non-judgmental; and they reduce labor costs. The advantage to videodiscs in particular is their ability to offer non-readers motion, color, high quality sound, and full interactivity (when linked to a computer). Adults who cannot read at all are the ones who need the richest instructional environment. The disadvantage to videodiscs is the cost of production and the required player/computer hardware, which virtually no community adult literacy center has.

Ordinarily, illiterate adults do not like to study in traditional schools since they associate schools with their previous academic failure. Research has shown that in every community there are certain individuals who help others with their reading requirements on an informal basis. The NCLT's high technology adult literacy plan calls for assisting these "literacy helpers" with televised and printed resources. The potential is great for reaching many more adults in this way than could be reached in academic settings.

Even this approach would be difficult to implement in rural areas. In these cases, the adult population would be served better by combining videotext and teletex with television. Videotext is the two-way (interactive) transmission of information using coaxial cable or telephone lines. Teletex is a one-way transmission of data using the vertical blanking interval of a broadcast television signal.

Using videotext, interactive computer assisted instruction could be delivered directly to individual homes or other locations like rural schools or community centers. Teletex would allow the reception of print and graphic information. Teletex also can transmit computer software programs directly to home computers. These transmissions could be supplemented by printed materials, audiocassettes, and telephone access to instructors.

Service Strategy

It is not sufficient to provide turn-key products without the ancillary services for putting those products to use. The NCLT offers educators those services, including training for computer teachers. Forecasters have pointed to an impending teacher shortage. The demand for teachers does not equal the supply, which itself provides a powerful impetus for technology-based solutions. The NCLT staff has an exemplary record of training teachers and administrators to integrate technology into the classroom and school office. The continuing need for technology training becomes obvious in light of school hardware purchases. The number of classroom computers has doubled every year in recent years, and the Center is poised to train school personnel to use the new technologies to full effect.

Other NCLT services include technical support, hardware and software evaluation, negotiation of software licenses, computer literacy and computer science curriculum support, and consulting services in:

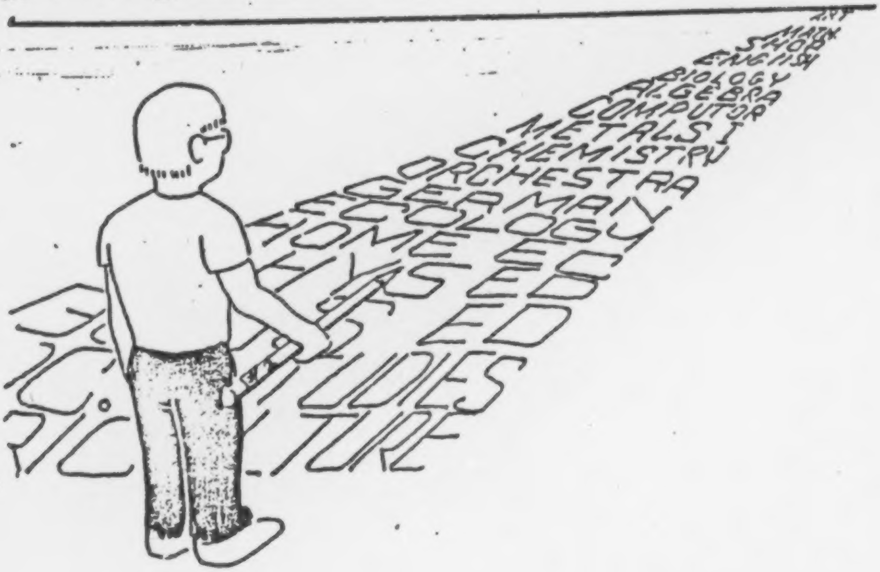
- program planning
- proposal development
- curriculum integration
- research and evaluation of computer-based curriculum

APPENDIX E

Blue Earth, Minnesota, Public School, Learning With Technology: Scope and Sequence Plan

From: Blue Earth Public School, The Development of A Computer Intensive Program, 1986.

PROJECT BEACON



THE DEVELOPMENT OF A COMPUTER-INTENSIVE PROGRAM

BLUE EARTH
PUBLIC SCHOOL
BLUE EARTH, MN

LEARNING WITH TECHNOLOGY

Scope and Sequence

The following k-12 scope and sequence for learning with technology was developed for the Blue Earth Public School. This scope and sequence is part of a technology utilization plan that was prepared by the Blue Ribbon Committee on Computer Literacy in 1981.

During the 1984-85 school year, the Minnesota State Legislature encouraged all public schools in the state to develop a plan for the integration of technology into the curriculum. Ninety-five percent of the schools completed an approved plan during the year.

It is interesting to look at the scope and sequence now, five years later, and make some observations.

> The plan has a heavy emphasis on drill and practice activities. Drill and practice continues to be a popular use of computers, especially in the early grades. Spelling and math facts drills are the most popular.
>
> Programming is mentioned as a part of the math curriculum beginning at grade three. Very little programming is actually taught in the elementary school. The emphasis in now on using the computer as a tool in the learning process, rather than teaching programming skills.
>
> Although drill and practice activities are still considered an appropriate and beneficial use of the computer, the creative uses show more promise for actually improving education. The creative uses include LOGO, word processing, database management, and many others.
>
> When programming is mentioned, BASIC is the language intended by the authors. LOGO is never mentioned. LOGO is now taught as part of the math curriculum to enhance problem-solving skills.

The Blue Earth School begins keyboarding during the second half of the year for all third grade students. Keyboarding skills are reinforced through drills and through use of the skill for word processing activities after the initial instruction is completed.

Computer technology is now used extensively throughout the school. Some video production is being done at the present time. Very little is done with the other technologies.

Although there have been some changes, the plan has served as an important guide for developing a strong computer program in the school.

In 1985, the Blue Earth Public School began work on the next five year plan for integrating computer technology into the curriculum. The plan will be completed during the 1986-87 school year.

C - computer
T TV/VCR/film
IV - interactive video
M - microwave ovens
S - satellite communication
R - educational radio

LEARNING WITH TECHNOLOGY
(K-3 Scope and Sequence)

	Kindergarten	Grade 1	Grade 2	Grade 3
Art	C- colors and color words	T- video trips	T- video trips	T- video trips
Health	T- video trips - hospital, clinic, water treatment plant; dentist			
Language Arts	C- spatial comparison T- tape sounds and numbers for self-correcting	C- Spelling drill and practice	C- Spelling drill, grammar, punctuation	C- Spelling, parts of speech, correct usage
Math	C- number recognitions, shapes and sizes, counting	C- drill and practice: basic facts, sets, time, money, relationships	C- drill and practice: basic facts, story problems, money, and time	C- facts drill, simple programming
Music	C- notes and pitch drill	R- education radio	T- tape plays	
Physical Education	C- fitness scores; outline movements for visual evaluation, showing specific area to be improved T- tape movements for self-evaluation; large screen TV for demonstration			
Reading	C- letter and word recognition, ABC sequence, color words T- oral reading	C- drill and practice: consonant and vowel sounds, phonics, computer vocabulary IV- interview authors	C- vocabulary, comprehension, and speed reading IV- interview authors	C - vocabulary
Science	T- demonstrations	T- experiments	C- computer vocabulary (LOGO)	C- vocabulary computer parts
Social Studies	T- video trips	C- directions T- video trips: Post Office grocery store, museum M- baking in class S- foreign holiday customs	C- community computer uses T- video trips M- baking in class S- foreign holiday customs	C- simulations T- video trips: Washingto S- Nigeria, Brazil, Moscow, London
Special Education	C- drill and practice, vocabulary, Voice Input Module (VIM), Voice Print Speech, data base T- video trips			

C - computer
T - TV/VCR/film
IV - interactive vido
M - microwave ovens
S - satellite communication
R - educational radio

LEARNING WITH TECHNOLOGY
(4-6 Scope and Sequence)

	Grade 4	Grade 5	Grade 6
Art	C- graphics T- video trips: artists, Art Show, show on cable TV S- art exhibits around world	C- graphics T- video trips: artists, Art Show, cable TV	C- graphics T- video trips S- exhibits around world
Health	C- vocabulary T- video trips, Public Health IV- interview experts	C- nutrition, diet, and exercise T- video trips	T- video trips IV- interview experts
Language Arts	C- drill and practice: Spelling, grammar, punctuation, keyboarding T- tape speeches	C- Spelling, vocabulary, keyboarding T- tape speeches	C- Spelling, word analysis, parts of speec guide words, keyboarding T- tape speeches
Math	C- facts drill, logic, simple programming	C- Micro-Math Magic, logic, metrics	C- Micro-Math Magic, Base 2 and computer
Music	C- key signatures, follow the note, rhythms, time signatures T- rehearsals and performances S- world performances		
Physical Educ.	C- game rules and fitness scores		
Reading	C- drill: prefixes T- tape plays IV- interview authors	C- prefixes T- tape plays IV- interview authors	C- comprehension, speed reading IV- interview authors
Science	C- simulations, review computer parts T- video trips, tape experiments - cable TV IV- interview scientists	C- simulations, circulation T- video trips, tape experiments, tape Science Fair for cable IV- interview scientists	C- simulations, computer functions T- video trips, tape experiments IV- interview scientists
Social Education	C- simulations, careers, computer vocabulary T- video trips M- baking in class	C- simulations, history of computers, computer vocabulary T- video trips	C- simulations, Minnesota computer careers T- video trips
Special Education	C- drill and practice, vocabulary, data base, Voice Print Speech		

C - computer
T - TV/VCR/film
IV - interactive video
M - microwave ovens
S - satellite communication
R - educational radio

LEARNING WITH TECHNOLOGY
(7-9 Scope and Sequence)

	Grade 7	Grade 8	Grade 9
Art	C- graphics, art history, testing, art design projects T- tape classes for Art Show, educational TV, film animation, produce films IV- interview artists, view other classroom art programs throughout the world		
Health	(Grade 9 only) C- body systems, simulations, vocabulary drill		
Language Arts	C- drill and practice: speed reading, Spelling, vocabulary, grammar, word processing T- tape speeches, plays, lessons for absentees, video trips, educational TV IV- interview writers and other guests S- view other classrooms in U.S. and foreign countries		
Math	C- computer chess, basic programming	C- binary number system and relationship to computers	C- algebra on computer, basic programming, careers T- video trips
Music	C- ear training, rhythmic dictation, theory, cross-referenced list of all music in district schools, uniform and robe assignments T- rehearsals, tape performances of visiting groups		
Physical Education	C- game rules and strategies, software library T- tape student skills, cable TV - demonstsations to community, video trips IV- interact with community		
Reading	C- comprehension work		
Science	C- population and ecology studies quantative analysis T- video trips	C- quantative analysis, drill: rock identification	C- quantative analysis, simulation: heat loss
Social Studies	C- simulations	C- drill: longitude and latitude	C- history of computers, career profile, computers in society, simulations T- tape behaviors, cable to community
Special	C- drill and practice: Math, Language, Vocabulary, Spelling, Geography, simulations T- video trips - vocational opportunities, tape lessions for homebound IV- phone conference calls to parents who can't attend conferences		
Guidance	C- ACT Discover, MCIS and GIS, employment opportunities T- video trips - Human Services		
Home	(Grade 9 only) C- nutritional analysis, budget and menu planning, recipe file		

C - computer
T - TV/VCR/film
IV - interactive video
M - microwave ovens
S - satellite communication
R - educational radio

LEARNING WITH TECHNOLOGY
(10-12 Scope and Sequence)

	Grade 10	Grade 11	Grade 12
Art	C- graphics, art history, testing, art design projects T- tape classes for Art Show, film animation, produce own films S- art programming throughout world		
Health	(Grade 10 only) C- lifestyle profile, simulations T- & IV- tape interviews with consultants		
Language Arts	C- drill and practice: Spelling, grammar, vocabulary, word processing T- tape student productions, cable TV - student interviews/panel discussions		
Math	C- algebra, geometry programming	C- advanced algebra, trigonometry	C- programming
Music	C- theory, uniform and robe assignments, list of music in district schools T- tape rehearsals for absentees, tape performances of visiting groups		
Physical Education	(Grade 10 only) C- game rules and strategies T- tape student skills, cable TV demonstration to community, video trips		
Science	C- quantative analysis, simulations T- video trips - testing and lab demonstrations IV- interview experts		
Social Studies	C- history of computers, simulations	C- drill and practice, impact on society, careers T- tape oral presentations, make own shows, video trips IV- interview government officials	
Special Education	C- simulations, drill and practice: Math, Language, Vocabulary, Spelling, Geography T- video trips - vocational opportunities, tape lessons for homebound IV- phone conference calls to parents who can't attend conferences		
Business	C- word processing, speed and accuracy drills, accounting loan and interest analysis T- video trips to court IV- interview lawyers		
Driver's Educ.	(Grade 1[illegible] only) C- testing, drill and practice T- video trips IV- interviews		
Guidance	C- ACT Discover, MCIS and GIS, employment opportunities T- video trips - Human Services		
Home Economics	C- nutritional analysis, menu and budget planning, recipe fil T- video trips to Small Claims Court, Dissolution Court		

APPENDIX F

Shakopee, Minnesota, Public Schools, "Technology Assessment: Current Status of Computer Technology"

From: Shakopee Public Schools, Five Year Plan, 1987.

TECHNOLOGY ASSESSMENT

CURRRENT STATUS OF COMPUTER TECHNOLOGY

INSTRUCTIONAL COMPUTERS

Instructional use at the elementary level includes Computer Assisted Instruction (CAI), Computer Managed Instruction (CMI), keyboarding, and wordprocessing. Instructional computer use at the junior high is primarily limited to mathematics, computer science electives and special education. The senior high instructional program offers a full elective series of programming in Basic and Pascal in addition to simulation units and drill and practice as appropriate. Business courses offer computer applications in wordprocessing, databases, spreadsheets and accounting practices.

The Industrial Technology Department has incorporated Computer Assisted Design (CAD) into its curriculum. Home Economics is making use of instructional computing with a variety of simulation software.

ADMINISTRATIVE COMPUTERS

Administrative computer utilization is accomplished through a combination of micro computer and T.I.E.S. main frame computer applications. Presently the following administrative tasks are computerized: Personnel/payroll, financial accounting, student records, student scheduling, student attendance, mark reporting (secondary), transportation, district census, instructional management, and energy management.

COMMUNITY EDUCATION COMPUTERS

Use of district technology is limited to course offerings in computer literacy, computer programming, and computer selection. Administratively, Community Education is implementing a micro-computer based facility scheduler and financial reporter.

CURRENT STATUS OF VIDEO TECHNOLOGY

VIDEO TAPE

Shakopee Senior High, Shakopee Junior High, Sweeney Elementary and Pearson Elementary buildings have 1/2" VHS cassette tape playback capabilities. Utilization is primarily for playback of prerecorded materials. Throughout the district, video systems are also used to record selected student activities for playback.

CABLE TELEVISION

Construction is currently in progress which will bring cable television to all five district buildings. The system will be inter-connected with the Chaska Cable Television system allowing for future development of shared production. It is anticipated that both Chaska and Shakopee School Districts will benefit by sharing instructional staff through interactive cable connections thus reducing the need to transport students between districts.

Pearson Elementary, Sweeney Elementary, Shakopee Junior High, and Shakopee Senior High are all totally wired with video distribution systems to all teaching stations. Central Elementary has no video distribution system at this time. It is anticipated that Central Elementary will need to have a distribution system installed as cable television for instruction is expanded.

CURRENT STATUS OF TECHNOLOGY - INSERVICE

COMPUTER INSERVICE

The school district has actively encouraged inservice training on computers and their uses for more than ten years. This training has consisted of on-campus college courses, off-campus college courses developed to address district needs, locally developed inservice courses, conference attendance, and a variety of T.I.E.S. workshops. As a result of this effort, the vast majority of the staff is at a moderate to high skill level relative to hardware and software. Future inservice needs to be in the area of software evaluation, instructional integration.

VIDEO INSERVICE

Staff currently has only a moderate knowledge of video and communications technology. As current pilot projects mature, it will be necessary to expand inservice in this area.

INSERVICE AND TRAINING SUPPORT PLAN

TECHNOLOGY RESOURCE TEACHER

A review of the progress made in both hardware and software implementation as a result of the Four Year Technology Demonstration Grant indicates a strong need to continue the current level of support. The Board of Education voted at the March 9, 1987 meeting to continue a full time Technology Resource Teacher.

BUILDING TECHNOLOGY TEAMS

Hardware and software support will be further enhanced with the implementation of Building Technology Teams.

Teams will consist of staff members from each school whose primary purpose is to facilitate the implementation of computer education in the school.

MEMBERSHIP

Elementary:

1. Media Specialist
2. Primary teacher
3. Intermediate teacher
4. Building Key Instructional Contact
5. Other personnel identified by the principal

Junior and Senior High:

1. Media specialist
2. Teacher from each department
3. Building Key Instructional Contact

Criteria for Selection of Members

1. Interest in computer education
2. Willingness to share tips and techniques with other staff members
3. Basic computer knowledge
4. Credibility with staff

BUILDING KEY INSTRUCTIONAL CONTACT (KIC)

One staff member should be identified by the Technology Coordinator and Building Principal as the Building Key Instructional Contact. This person would be responsible for the following:

1. Chairing the Building Team
2. Scheduling the computer labs
3. Assist with software installations on the LAN
4. Arranging training for staff through the Technology Office.
5. Communicating with other Building KIC'S and with the District Technology Office.
6. Performing minor maintenance and repair on hardware and software.
7. Arranging for the more complex maintenance of hardware and software through the Technology Office.

Training

The team from each school will be trained by the district Technology Office. Additional in-service needs will be provided throughout the school year. It is anticipated that the administration will reserve some workshop days for continued training.

1985-86
PER COMMITTEE RECOMMENDATIONS

In order to address the continual development and implementation of ways to provide the highest quality educational services possible for all students in the Shakopee School District, there is a need to systematically review one or more curricular areas on an annual basis. The 1985-86 PER Committee was charged by the Board of Education to make recommendations for program improvement in the areas of reading, health, and physical education.

Curricular change is inevitable. If curricular change is to be productive, it must be carefully planned to improve existing conditions through the consideration and adoption of new technologies, new ideas, or old ideas for which the time is now right.

After careful study and consideration, the District 720 PER Curriculum Advisory Committee has mad the recommendations included in this report. It is important to recognize that these recommendations are means to an end not an end in themseleves. They represent a starting point, not a place to be. Our recommendations constitute the beginning of what should be done in District 720. Our expectation is that a broad base of participants, including teachers, parents, students, board members, and administrators, will work together in accomplishing these recommendations.

Technology

1. Additional support personnel for computer labs could enhance the utilization of those labs.

2. Increased opportunities for computer and computer-related inservice training should be provided to all district staff.

3. A schedule for replacing/maintaining computer hardware and equipment should be developed.

4. Expanding the use of computers outside the computer lab setting should be explored, and a hardware acquisition plan should be developed, if warranted.

5. Attention should be given to providing the necessary hardware appropriate for integration into the business education curriculum.

6. Exploration of the use of interactive cable capabilities to expand program opportunities for students should continue.

7. The Board should set K-12 goals to provide enough computers to accommodate full classes of students in the lab setting. The goal should also address providing a minimum of at least one computer per classroom K-12.

8. The district's current emphasis on keyboarding at the elementary level should continue.

9. Immediate plans should be made to upgrade the business education curriculum so that it is more technologically viable.

APPENDIX G

State of Minnesota, Selected Materials

"Introduction," *From* State of Minnesota, Minnesota Technology Demonstration Sites, January 1986.

State of Minnesota Legislation, "Omnibus Education Act, 1977 (Draft)"
  Article 5 - "State Agency Services"
  Article 7
  Article 8 - Technology and Educational Improvement

Minnesota Department of Education, "Information Technology Philosophy", *from* Information Technology Learner Outcomes: An Overview, undated.

INTRODUCTION

The sections of Article 8 in the Educational Omnibus Bill dealing with educational technology have received a great deal of state and national attention. The comprehensiveness of this effort and its sizable $6,300,000 biennial budget are factors in its national identity. The degree of participation by districts in a voluntary program and the quantity and quality of assistance given at the Minnesota Technology Demonstration Sites are reasons for its visibility in the state.

Technology is extremely important to Minnesota's economic well-being. Given our cold winters, lack of energy resources and the existence of a highly educated population, technology is extremely appropriate for reducing our disadvantages and exploiting our advantages. Forty percent of our economy is linked to high technology. Minnesota's national and world business identity revolves around such names as 3M, Control Data, Honeywell, Sperry, IBM and Cray Research. All have major operations employing thousands of people. Equally significant, the other business identities that Minnesota has, such as those of a banking, medical research, insurance and agribusiness center are also technology intensive.

Beyond economics, there are several major reasons it is important to use technology in education. The most obvious one today is use of technology to help provide better instruction. Examples include providing low-incidence courses, individualizing education, providing drill and practice, managing learner objectives and monitoring student progress. Technology in schools also helps students access information and enhances their ability to think, make decisions and solve problems. Technology tools such as databases, electronic spreadsheets, word processors and simulators allow students in all geographic locations to manage data in a very sophisticated manner. Telecommunications allow motivation and interest to be the major determinant of lifelong learning by reducing present limiters of participation--age and location of residents.

Given economic and educational reasons, it will probably not surprise readers that Minnesota's people expect their students to be knowledgeable about technology and its uses. In fact, Minnesota has been perceived as a leader in educational technology for many years. State-owned Minnesota Educational Computing Corporation (MECC) and Council on Quality Education (CQE) projects provided schools with quality courseware at a time when commerical producers were not ready or willing to risk development funds. Minnesota's research money also encouraged districts to experiment with new methods of delivering instruction. For instance, CQE funding made possible the first installation of a low-power two-way television school network and the first K-12 production and use of videodisks in the United States.

However, like other states and provinces, Minnesota was having difficulty maximizing the potential which modern technology offers schools. Most people agreed that Minnesota's technology educational efforts were random, and often showed little direct link to the existing missions of schools. Instead of using technology to enhance learning, educational technology efforts were focused around teaching students to program computers; even that effort was made rather poorly. Where technology was used for instructional purposes, it was often done in a drill-and-practice format, accomplishing nothing more than using technology as electronic workbooks. Even more foreboding, technology was being perceived as the domain of only a few subject areas.

Courseware was another major problem. Thousands of software items were being produced, but only about twenty percent warranted use. Teachers were frustrated that there was not initial selection and felt unable to devote large amounts of time to preview materials. Even when good software was found, teachers were unable to obtain content-related inservice. Many teachers recognized the importance of technology, but were unaware of or unable to visit schools where successful uses of technology were taking place.

Education leaders cautioned Minnesota legislators that the state's perceived leadership was based on the work of a few exemplary districts and the existence of a lot of hardware and that, unless major steps were taken, there was little chance for fulfilling the potential of technology across the state. Legislators, acknowledging the importance of educational technology in educational improvement efforts and the economy, responded with a biennial budget of $6,300,000 for the following educational technology initiatives:

TECHNOLOGY UTILIZATION PLANS

A problem that was quite obvious to many people revolved around purchases of equipment without a clear understanding of where in the curriculum the technology, especially computers, would be used. Many school districts, concerned that they not be viewed as backward, purchased equipment first and worried about integrating it into the curriculum only when faced with using the equipment. Many districts perceived computer literacy as an end in itself and viewed programming as the concluding activity of a student's interaction with technology. Even more discouraging, many of the equipment purchases were found to be inappropriate or lacking sufficient courseware.

To encourage technological planning, the Minnesota Legislature provided technology planning incentives. Every school district in the state was given the opportunity to receive 75 cents per student or a minimum of $500, whichever was more, to develop a technology utilization plan. The Minnesota Department of Education was given responsibility and funds to develop support documents and model plans that districts could use for their own districts. The Minnesota State Board of Education and the Minnesota Department of Education were given responsibility for determining the criteria and approving the plans.

The Minnesota Department of Education, with the assistance of school district personnel acknowledged for their technology planning skills, developed a 94-page document titled "Planning for Educational Technology." The Department then inserviced the document in 15 workshops throughout the state.

School districts responded extremely positively to these technology planning incentives. Ninety-seven percent of the districts applied for funds and submitted satisfactory plans. Evaluations indicated that the districts found the document and the workshops very helpful and many have indicated that they plan to use the same procedure to develop plans for various other curriculum areas.

INSERVICE TRAINING FOR USE OF TECHNOLOGY

Needs assessment and testimony before the Legislature indicated that inservice training for staff should be a priority. It was clear that a variety of opportunities should be made available in a variety of formats. Sufficient funds were allocated to provide districts with $1 per student for inservice, which district staff determined to be of highest priority to them. To receive these funds, districts needed an approved technology utilization plan and a brief agenda of activities that would be offered to staffs with the monies from this section of the law. Funding of seven regional MECC coordinators was a second kind of inservice assistance to districts. These coordinators had special responsibility for making district people aware of new MECC materials and helping them learn how to use them. MECC coordinators were also able to provide ongoing regional assistance in other areas of high priority to districts.

The Minnesota Department of Education was allocated $220,000 to provide state and regional workshops that had appeal beyond one district. These funds are being allocated in the following manner: Approximately one-third of the money is being used to fund special interest workshops, one-third to provide advanced implementation assistance workshops and one-third to professional content or interest organizations to provide programs to their clientele groups. The grants to professional organizations have been especially well received by educators and it has given those organizations additional viability. Approximately 5,500 people participated in inservice activities during the first year and another 15,000 people participated the second year in workshops funded through the Department's appropriation.

COURSEWARE PACKAGE EVALUATION

A major frustration for educators attempting to use technology has been the unknown quantity and quality of software on the market. For some content areas, there are limited amounts of software produced by small production houses whose expertise is unknown. For other areas, such as elementary mathematics, the quantity is so immense that teachers are unable to review all software materials.

Minnesota has attempted to deal with this problem by developing the "High Quality Courseware List," which it publishes every six months. The "High Quality Courseware List" is an evaluation rather than an approved or disapproved courseware list; districts may purchase what they wish. The state will, however, reimburse school districts for 25 percent of the cost up to $1 per student for materials purchased which are included on this list.

Evaluation of courseware materials is done by specially designated teams that use standardized Minnesota State Board of Education--approved checklists. Each team consists of three practicing teachers from the appropriate grade level or content area who field-test the packages in their classrooms; one technology expert knowledgeable in software and documentation techniques; and one curriculum expert from the Minnesota Department of Education or a designee. Non-department evaluators are paid a small stipend per disk depending on the number of disks included in each package.

COURSEWARE PURCHASE

Article 8 Legislation authorizes the Minnesota Department of Education to purchase rights to duplication of courseware and/or make volume purchases if the courseware packages "are available to the state at a lower cost than if purchased by school districts individually." The Minnesota Legislature has appropriated nearly $500,000 over a four-year period for this purpose. During the first years, about half of the expenditures were focused on purchases of video materials and computer utility materials which could be used with a variety of subject areas. The rationale was that in every school, several people found very appropriate uses of materials that were more generic. The other half of the funds were used to purchase courseware that encouraged thinking skills in a variety of content areas.

COURSEWARE PACKAGE DEVELOPMENT

The Minnesota Legislature also gave the Department $500,000 over four years and the authority to contract for the design and development of courseware packages which will meet the needs of the school districts and which otherwise are unavailable or too expensive for individual districts or the State of Minnesota to purchase. A major use of these funds had been to design and develop packages which help students learn how to manage information, especially through use of databases. Another priority has been the development of videodisk courseware which would both provide students assistance in content areas and make teachers aware of the potential of this technology.

TECHNOLOGY DEMONSTRATION SITES

The Minnesota Technology Demonstration Sites are the most visible components of Minnesota's technological innovations. Partially, this is because the $2.2 million appropriation in each biennium was significant, but more because of the great interest by districts to be designated exemplary sites and thus benefit from additional funding and prestige.

Almost everyone agrees that demonstration sites are crucial in Minnesota's efforts to increase the quality use of technology. There are numerous reasons why demonstration sites are important. Four of those reasons are:

1. Technology, to have meaning, must be experienced. Most educators did not have opportunities to use or receive instruction through technology. They are not aware of the changes and opportunities that have developed in the last few years. Technology becomes most tangible through use.

2. Technology inservice, to have credibility, must be based in actual school settings. Teachers, to be believers, need to see other teachers successfully use technology while working under real conditions, with a variety of students. We have found that a visit to a site has more initial meaning to teachers than extensive inservice offerings.

3. Technology use and inservice, to be improved, must be done under conditions that have enough commitment, equipment and trained staff to test desired effects.

4. Educators need opportunities to visit locations that have people available who can help visitors see the significance of their efforts and help them envision appropriate applications in the visitor's school district. Additionally, funds need to be available for transportation costs of visitors so that travel money does not become the excuse for not visiting sites. The Minnesota Legislature designated $300,000 each biennium for transporation incurred by visitors from other Minnesota public schools and for workshops conducted at or by Minnesota Technology Demonstration Sites.

The original 15 demonstration sites and the five new sites offer learning opportunities to all districts regardless of their size or technological sophistication. The sites will show visitors a variety of technologies in very different settings. Visitors can choose to see five different delivery systems of two-way television ranging from microwave to fiber optic. They can observe the advantages and disadvantages of using computers in four different classroom organizational formats. They are able to visit sites which have one dominant technology or visit sites with six or seven major technologies. Size of host districts ranges from a few hundred students to thirty-four thousand. There are sites that serve only one district and others that serve more than 15. They are located in areas ranging from the lightly populated lake country of the far north to the most innercity. Some sites are known nationally for their technology curriculum management programs and others are themselves just recognizing the potential of their equipment. The most significant component of all the sites, however, are the people who have a responsibility to help visitors make sense of what they are observing and recognize appropriate applications of educational technology in their own schools.

SF 00006 03

STATE OF MINNESOTA

DEPARTMENT Education

Office Memorandum

TO Staff Development and Instructional Implementation Unit Staff

DATE May 27, 1987

FROM Richard J. Mesenburg, Supervisor
Staff Development and Instructional Implementation

PHONE 6-4064

SUBJECT Legislative Overview

Attached is a draft dated May 26, 1987, which summarizes some of the legislation passed during the last legislative session. I think you will find this helpful to you to use in conjunction with the more complete document that Harold brought to you yesterday. If you have any questions about it, please contact me.

RJM:mhWk

Attachment

5/26/86

DRAFT

Omnibus Education Aids Act
Laws 1987, Chapter ______

OVERVIEW

The omnibus education aids law of 1987 provides increases in revenue for school districts for school years 1987-88 and 1988-89. There are modifications in various funding formulas, including adjustments aimed at promoting equity in funding and consolidating funding for selected categorical programs.

The law also provides for the continuation of innovations which promote access to excellence in education. Included are voluntary programs for cooperation through education districts, area learning centers and enrollment options. Other provisions relate to teacher education curriculum, teacher centers, professional development, educational outcomes, student assessment, graduation incentives and drop-out prevention.

"STATE AGENCY SERVICES"

ARTICLE 5

This article provides state appropriations for the following programs conducted by the Board of Teaching and Department of Education:

Board of Teaching (Section 1.)	FY 1988	FY 1989
1. **Assessment of Teacher Performance**	$166,000	$166,000
To design an assessment procedure related to the plan for evaluating teaching skills of beginning teachers.		
2. **Exemplary Teacher Education Programs**	$135,000	$135,000
To develop alternative educational practices within teacher education institutions and disseminate and replicate program models.		
Department of Education (Section 2.)		
1. **Office on Transition Services**	$ 77,000	$ 77,000
To fund the interagency office, which provides services for transition of secondary age handicapped pupils from school to work or post-secondary training programs.		
2. **Early Childhood Family Education**	$ 31,500	$ 31,500
To provide technical assistance to school districts implementing early childhood family education programs.		
3. **Community Education Advisory Task Force**	$ 25,000	----
To fund development of a statewide plan for addressing the needs of and opportunities for youth from birth to age 21 and model plans for an interagency approach by local advisory councils.		
4. **Management Information Centers**	$3,410,700	$3,410,700
To provide support for operating regional computer centers and maintaining current software programs.		

5.	**Academic Excellence Foundation** To provide support for programs which advance the concept of educational excellence and to develop and implement a plan for an academic league.	$100,000	$125,000
6.	**Health and Wellness Curriculum** To develop and disseminate planning materials and guidelines to assist districts in developing comprehensive health curriculum.	$ 30,000	----
7.	**Adminstrators' Academy** To provide support for an education administrators' academy and the school management assessment center at the University of Minnesota.	$167,300	$167,300
8.	**Educational Effectiveness** To fund efforts in planning and implementing programs to maintain and improve educational effectiveness in schools, including funds for regional coordinators.	$690,300	$690,300
9.	**State PER Assistance** To provide technical assistance with assurance of mastery programs, develop model learner expectations, and fund the curriculum advisory committee, assessment item bank, and local assessment program.	$428,000	$661,000
10.	**Curriculum and Technology Integration** To provide support for efforts in technology services, courseware integration centers, technology innovation dissemination, and purchase of technology courseware.	$1,405,000	$722,000
11.	**Comprehensive Arts Planning** To provide technical assisstance to arts education committees in the districts.	$ 37,500	$ 37,500
12.	**ECSU Administration** To provide support for the administrative costs of the 9 regional educational cooperative service units (ECSUs). Before releasing funds to the ECSUs, the SDE must assure that the annual plan of each ECSU addresses services that can be better provided by an ECSU than by a member district. The annual plan must include methods to increase direct services to school districts and, beginning with the 1988-89 school year, the plans are to be coordinated with the SDE's management plan.	$748,000	$748,000

Department of Employee Relations (Section 3.)	$ 50,000	----

To develop a plan to allow teachers and school boards the option of participating in a state health benefits program.

ARTICLE 7

School District Deposits and Investments

Technical changes are made in laws relating to the depository and the investment authority for school districts. (Sections 1, 2, and 3).

Enrollment Choice for Eleventh and Twelfth Grade Students

Eleventh or twelfth grade students who have been enrolled in a district for at least three years and whose parent or guardian moves to another district, may remain in the nonresident district with the approval of the school board of that district. The approval of the School board of the new resident district is not required. For purposes of funding, the student shall be considered a resident of the district in which the student is enrolled. (Section 4)

Summer School Electives

Allows school districts to offer any elective secondary course during the summer and sitll comply with State Board rules. (Section 5)

Foundation Programs

The foundation shall plan for programs which advance the concept of educational excellence. (Section 6)

Academic League Plans

This legislation directs the academic excellence foundation to plan for an academic league. The plan shall be developed in consultation with administrators of existing programs of academic competition and cooperation, the Minnesota State High School League, and the Minnesota Association of Secondary School Principals. Plans shall be submitted to the education committees of the legislature by January 15, 1989. (Section 7)

Report

Directs the foundation to submit to the legislature an annual report containing financial information for the preceding year including foundation receipts and expenditures. (Section 8)

Foundation Publication

The foundation may produce publications related to its purposes and collect reasonable fees for such publication. (Section 9)

Appropriation

There is annually appropriated to the foundation any and all amounts received for its publications. (Section 10)

Regional Management Information Centers

Any district that is using a state approved alternative finance system may transfer their affiliation from one region to another. These districts are liable for their contracted proportionate share of the outstanding regional debt and must give at least a one-year written notice of their intent to transfer in advance unless the two regions involved mutually agree to waiver the advance notice timelines.

This language also clarifies that all districts must report their financial data to the State via their region of affiliation except for the three districts that are currently reporting their financial data directly to the state (Ortonville, Plainview, and Randolph). (Sections 11 and 12.)

Account Transfer for Certain Severance Pay

A school district is allowed to designate a portion of their unreserved fund balance for certain future severance pay obligations. The obligations are defined as compensation for accumulated sick leave to be used for payment of premiums for group insurance provided for former employees by the district. The amount transferred shall not exceed 50 percent of the total calculated obligations as defined by the UFARS Advisory Council. (Section 13.)

Integrated Data Base

Section 121.932 is amended to require the Department to define the information (data elements) which districts need to submit to the Department regarding student, staff, and educational programs. Districts must send these data to their ESV regional computer center who will transmit the data to the Department. The definition of data elements is exempted from the rule-making process. (Section 14 and 15)

ESV Computer Council

Section 121.934 is amended by eliminating the position of ESV Computer Council Executive Director. It also adds a person from the Department to the ESV Compute Council and states that payment of expenses to Council members is not required. (Sections 16, 17 and 18)

School Nurse

School districts with more than 1,000 pupils must employ at least one full-time licensed school nurse. The board may contract with a public health agency for nursing services. Districts which have not declined in enrollment must retain the number of licensed nurses that it employed during the 1986-87 school year. (Section 20)

Levy Adjustment Proceeds

Clarifies that, when a school district sells school buildings or real property, there is no adjustment to tax levies unless the district uses the proceeds for removal or encapsulation of asbestos or for clean-up of polychlorinated biphenyls (PCBs). If a district uses the proceeds for these purposes, the hazardous substance levy limitation is reduced accordingly. (Section 21)

School Site Management Agreements

School boards may enter into an agreement with a school site management team concerning the governance, management, or control of a school. The initial school site management team appointed by the school board shall include representatives of the principal, the teachers, other school employees, parents, pupils, and other members of the community. Any powers or duties not specifically delegated to the school site management team shall remain with the school board. (Section 22)

Appropriation Transfers

The existing provision in Minnesota Statute 124.14, Subd. 7, related to the funding of aid deficiencies is amended such that any excess aid appropriations must be allocated proportionately among the deficient appropriations. Previously, the method of allocating the excess funds was determined by the Commissioner of Education. (Section 24)

Appropriation Transfers

Aid Payments

Teacher Exams

Removes the requirement, previously set to take effect in 1988, that all new public school teachers and those applying for additional fields of licensure must pass "an examination of academic knowledge in each field of licensure." The requirement that prospective teachers seeking initial licenses in 1988 and after must pass "an examination of skills in reading, writing, and mathematics" remains in law. (Sections 28-29.)

Early Retirement

Teacher Education Programs

Removes the requirement that all teacher education programs in colleges and universities must offer, and students must take, physical education. Courses in health, however, will still have to be offered and students will have to take these courses. (Section 33.)

Administration of Medication in School

Prescriptions may be administered in the absence of a licensed school nurse under the following conditions:

1. Medication must be done according to the written order of a licensed physician and written authorization of a parent.

2. Medication must be brought to school in a container appropriately labeled by the pharmacy or physician.

3. Medications, not taken orally, or which have the potential of dangerous side effects, may be administered only by a licensed school nurse. (Section 34)

Summer Scholarships

Procedures followed by HECB in reviewing financial need are modified and the provision that set a scholarship minimum at $100 is removed. The maximum scholarship, however, still is not to exceed $1,000. (Section 35)

Purchase of Courseware Packages

This legislation changes the existing State's Rights Courseware program to a revolving cost program that requires the Department to recover purchase and duplication costs by charging local school districts for courseware they wish to obtain from the State. Legislation allows the State of Minnesota to obtain the advantages of volume purchase without the need for yearly appropriations to the Department. A one-time appropriation of $550,000 was made to provide start-up funding. (Section 37.)

Administration of Traffic Safety Education

The Commissioner of Education is permitted to use $100,000 each year from funds in the alcohol impaired driver education account to administer grant programs relating to alcohol impaired driver education and other traffic safety education programs. (Section 38.)

Fund Balance Terminology

The fund balance terminology is changed in statute to agree with generally accepted accounting principles for governmental units.

Fund balances will either be reserved or unreserved and unreserved fund balances will be designated or undesignated. (Section 42.)

"ACCESS TO EXCELLENCE"

ARTICLE 8

Regional Services

Every two years, SDE is to evaluate the performance of ECSUs and other providers of regional services related to implementing educational effectiveness. (Section 1)

Education Districts

Permits school boards, through written agreement, to establish education districts for the purpose of increasing educational opportunities for students. At the time of its formation, an education district must be composed of any one of the following:

1. At least five districts.

2. At least four districts with a total of at least 5,000 pupils in average daily membership; or

3. At least four districts with a total of at least 2,000 square miles.

Education districts are to be governed by boards composes of at least one representative appointed by the school board of each member district. The general powers and duties of each Education District Board include the following:

1. Coordinate programs and services according to the terms of the agreement.

2. Employ staff and enter into contracts.

3. Appoint an advisory council.

4. Submit annual reports to member districts and the State Board of Education.

5. Adopt a comprehensive agreement for continuous learning, which is to be reviewed by all ECSUs in the region and updated annually. Several mandatory and optional features of a comprehensive agreement are specified. These agreements may provide for instruction throughout the entire year and may permit students to enroll in courses offered by any member district or transfer to nonresident, member districts.

6. Permission to issue bonds.

The law specifies procedures which must be followed in hiring and terminating teachers, including a requirement that positions not filled by currently employed teachers must be offered to available teachers from a combined seniority list.

No direct funding is available to Education Districts, but they are eligible for "Program Improvement Grants" (described below). (Sections 2-7.)

Superintendents

Clarifies law on the employment of superintendents. Specifies that when two or more school districts enter into an agreement for the purchase or sharing of a superintendent, contracting districts have the absolute right to select a superintendent without regard to seniority. (Section 8)

K-12 Enrollment Options Program (Section 9)

Establishment:

A voluntary enrollment options program covering K-12 students may be adopted by formal school board resolution. Participating districts agree to:

1. Allow its resident pupils to enroll in other participating districts;

2. Accept nonresident pupils from other participating districts; and

3. Follow the procedures of this section.

Districts shall notify the Commissioner each year by September 15 whether or not they will participate in the program during the following year. For the 1987-88 school year, districts must notify the Commissioner by July 1, 1987.

Application:

Students residing in participating districts may enroll on a form provided by the Department of Education. The application to nonresident districts shall be submitted by December 1 for enrollment during the following year. For the 1987-88 school year, applications must be submitted by August 1, 1987. The superintendent of the nonresident school district shall forward a copy of the application to the resident school district within ten days. The superintendent of the nonresident district shall notify the parents or guardians and the superintendent of the resident district by February 1 of the decision on the application except for 1987-88, when parents or guardians shall be notified by August 10, 1987. The parents or guardians must then notify the nonresident district within ten days whether or not they intend to accept and enroll their child in the nonresident school.

Basis for Approval:

Districts participating in the program may not deny application for enrollment unless:

1. There is lack of space in the district or within a program or

2. Acceptance of the application would put the district out of compliance with a desegregation plan that complies with State Board Rules. Once accepted to a school or program, the nonresident pupil must be afforded equal access to all curricular offerings.

Procedure:

Parents or guardians shall apply to the nonresident district by December 1 of each year for the following year except in 1987-88, when parents and guardians shall apply by August 1, 1987. The superintendent of the nonresident school district shall forward a copy of the application to the resident school district within ten days. The superintendent of the nonresident district shall notify the parents or guardians and the superintendent of the resident district by February 1 of the decision on the application except for 1987-88, when parents or guardians shall be notified by August 10, 1987. The parents or guardians must then notify the nonresident district within ten days whether they intend to accept and enroll their child in the nonresident school. If a student is dismissed from the school of choice, the student may not enroll in the district of residence until the matter is resolved.

Racial Balance:

If requested transfers in and out of a district having a desegregation plan will cause the district to be out of compliance with State Board Rules on Desegregation, the district shall set the number of majority and minority group students who may transfer in or out under this Subdivision so that the district or any school within the district will not be out of compliance. The selection of individual studens to transfer in or out must be made by the district based on equitable criteria developed by the school or may be by lot. The notice of selection or denial must be sent out to the applicants by November 20 on the form provided by the Department of Education except for 1987-88, when notice shall be sent by August 10, 1987.

Credits; Graduation:

Students qualifying to graduate who have attended school in a nonresident district shall be granted a diploma by that district. Districts shall count credit by other school districts towards a student's graduation requirement.

Information:

Participating districts make information about the district's schools programs and procedures available to parents, guardians, and children.

Transportation:

The district of enrollment shall provide transportation within that district for students enrolled under this Article. The state shall pay transportation aid to the providing district. Districts are not required to provide or pay transportation between a pupil's residence and the border of the district of enrollment. Parents or guardians may apply to the district of enrollment for reimbursement for transporting the child between the pupil's residence and the border of the district of enrollment. Parents or guardians may apply to the district of enrollment for reimbursement for transporting the child between the pupil's residence and the border of the district of enrollment. The State Board of Education shall make Rules to pay districts for reimbursing transportation based on financial need.

Aid to Students:

The foundation aid for districts must be adjusted for pupils attending nonresident districts under this Article. The adjustments are as follows:

a. The foundation aid paid to the district of residence must be reduced by an amount equal to the formula allowance (plus in 1987-88, the total tier revenue] per pupil unit times the number of pupil units attending other districts under this program.

b. The foundation aid paid to the district of enrollment shall be increased by an amount equal to the formula allowance [plus in 1987-88, the total tier revenue] per pupil unit times the number of pupils attending school in the district of choice.

c. If the amount of the reduction to be made from the foundation aid of the district of residence is greater than the amount of foundation aid otherwise due the district, the excess reduction must be made from other state aids due to the district.

Teacher Education

The Board of Teaching is to adopt rules by October 1, 1988, for the redesign of teacher education programs. The aim is "to implement a research based, results-oriented curriculum that focuses on the skills teachers need in order to be effective." The board is directed to implement new systems for evaluating teacher education programs, with an emphasis on the attainment by graduates of demonstrated program outcomes. Also, the board is to design and implement a teacher assessment system, "which requires candidates for initial and first continuing licensure to demonstrate abilities necessary to perform selected, representative tasks at appropriate levels."

The law supports research on the comparative effectiveness of alternative teacher education programs. By July 1, 1989, the Board of Teaching is to begin evaluating "the effectiveness of pre-baccalaureate, post-baccalaureate, and other alternative program structures for preparing candidates for entrance into the teaching profession." This is to be a longitudinal evaluation conducted by independent researchers who are not associated with Minnesota teacher education. The board is required to make a preliminary report on the effectiveness of alternative program structures to the legislature by July 1, 1990. (Sections 11-12.)

Teacher Assistance Through Mentorship

This program authorizes the Commissioner of Education to fund competitive grants that explore teacher mentorships. Many superior practioners with an interest in broad educational policy could be recognized and employed both inside and outside the usual classroom environment to support and enhance the effectiveness of beginning teachers. Creating mentorship roles for such teachers could help prevent costly attrition of beginning teachers and improve teacher competence.

Several new roles for cooperating school teachers would be defined and described. Roles could include mentoring and supervising teacher candidates, participating as adjunct teacher education faculty and serving as career teachers. The legislature appropriated $250,000 for each year of the biennium and requires the Commissioner of Education to appoint a Committee to advise on this program. (Section 13.)

Administrators Academy

The section of the professional development needs of adminstrators especially those of principals and superintendents. Because of matching federal funds, a committee consisting of representatives from the federal funds, a committee consisting of representatives from the major administrative organizations, higher education, private colleges and the Department of Education have designed an administrative professional development center that has three components.

The proposed center would provide the following services: (1) "An Administrator Assessment" that would result in an individual professional plan. (2) "Research and Development Assistance" which would provide current research and data of interest of adminstrators. (3) "Broker Services Unit" which would provide services and resources that would allow administrators to assist other administrators working on their "Individual professional plan." The fiscal resources identified to operate this center are annual appropriations of $143,000 of federal funds and a yearly state appropriation of $143,000. A yearly state appropriation for an additional $24,000 was made to fund the Assessment Center at the University of Minnesota. (Section 14.)

High School Graduation Incentives Program

The following students are eligible to participate in the high school graduation incentives program: (Section 15.)

a) Students of the ages of 12-15 who:

   1) Are at least two grade levels below the performanc elevel for students of the same age; or

   2) Are at least one year behind in credits for graduation; or

   3) Are pregnant or are parents; or

   4) have been assessed as chemically dependent; or

   5) have been absent from attendance at school with lawful excuse for one or more class periods on more than 15 days in the proceeding or current school.

b) Students of the ages of 15-18 who are attending school and who:

   1) Are at least two grade levels below their performance level; or

   2) at least one year behind in obtaining credits for graduation or

   3) are pregnant or

   4) is a parent or

   5) have been assessed as chemically dependent; or

c) Any person of the ages of 17-21 who has not attended a high school program for at least 15 days and who:

   1) is at least two grade levels below their performance level for students of the same age or

   2) is at least one year behind in obtaining credits for graduation or

   3) has been assessed as chemically dependent.

Eligible Programs

Eligible students may enroll in the following programs:

a) Alternative programs approved by the State Board of Education and school district work study programs;

b) The post secondary enrollment options program; and

c) any public secondary education program.

Enrollment

Approval of the resident district is not required for eligible students to enroll. A student enrolling in a program in a nonresident district shall be considered a resident of that district.

Desegregation

Students may not enroll in a nonresident district if their enrollment would result in violation of a district's state board approved desegregation plan.

Aid for Private Alternative Programs

If a student enrolls in a nonsectarian alternative program operated by a private organization that is contracted with a school district, the resident district must reimburse the provider an amount equal to at least 50% of the formula allowance [plus, in 1987-88, the total tier revenue] attributed to that student.

Career Options and Drop-Out Prevention Information

The Department of Education may collect reasonable fees for materials relating to career options and drop-out prevention. (Section 17.)

Planning, Evaluating, and Reporting--Accountability and Outcomes

Local Professional Development

The purpose of this program is to provide educators with educational renewal and development opportunities which would result in increased learning for students. Local school boards would be able to use an amount equal to $10 per pupil unit reserved exclusively for staff development if it establishes a staff development advisory committee and adopts a staff development plan. The staff development committee has specific membership requirements: one being that teachers must constitute a majority. School districts would have the opportunity to address needs analyzed and identified by school districts related to fourteen categories identified by law. (Sections 27-28.)

"Piggyback" Assessment and Revolving Account

Provides formal authorization to collect money from districts conducting Piggyback assessments. The article further authorizes the Assessment Section to sell products and services to brokers (i.e., other states, publishers) with the money from such sales to be put into a revolving account which is separate from the Piggyback account. (Section 26.)

Exemplary Teacher Education

A provision that required the Board of Teacher to award "at least three" grants to public post-secondary schools is eliminated. This program is funded with $135,000 in each of the next two fiscal years. (Section 30.)

Program Improvement Grants

Area Learning Centers

A school district may establish an area learning center by itself or in cooperation with: 1) other districts, 2) an ECSU, 3) an intermediate school district, 4) public and private secondary and post-secondary institutions, 5) public agencies, 6) businesses and 7) foundations. Such a center must serve at least two districts except for those in the city of the first class. Such centers shall have access to the districts regular education programs, technology facilities, and staff. (Section 34)

Nonresident Students

Students who do not reside in the district may attend the center without consent of the school board of the district of residence. The center shall provide programs for secondary students who are chemically dependent, not likely to graduate from high school, need assistance in vocational and basic skills, can benefit from employment experiences, and need assistance in transition from school to employment. Adults to be served by the center are: dislocated homemakers and workers who need basic educational and social services. The center's programs must be available throughout the entire year.

Foundation Revenue

Payment of foundation and general education aid for nonresident pupils enrolled in the center shall be made in the same manner as under the K-12 enrollment options program. (Section 37.)

Planning Grants

Up to 20 planning grants of $5,000 each may be awarded for fiscal year 1988 to existing alternative programs. These grants are designed to assist existing programs in becoming an area learning center by expanding or redesigning services. the Commissioner of Education shall award planning grants based on short descriptions of applicants current and proposed programs to recipients geographically distributed through the state.

Planning grant recipients then submit their plans to the Commissioner by January 1, 1988. (Sectoin 39.)

1988 Selection of Exemplary Centers

Based on the plans submitted, the Comissioner shall select four sites to be designated exemplary learning centers and shall award each site a grant of $37,500. (Section 40.)

Evaluation

The Commissioner shall provide an independent evaluation of the program and cost of the area learning centers and report to the legislature by February 1, 1989 and February 1, 1990. (Section 41.)

Teacher Centers (Section 42.)

Advisory Task Force

An advisory task force of 15 members is established to assist the Board of Teaching during fiscal years 1988 and 1989 to advise the Board of Teaching on the form and manner of applications for grants for teacher centers.

Upon approval of an application, the Board of Teaching shall award a planning grant of not more than $75,000 for the development of a final plan of operation for a teacher center.

During the 1988-89 biennium, a teacher center may be established by one or more school boards and the exclusive representatives of the teachers. The center shall serve at least ten districts or 3,000 teachers.

Center Functions

The center shall assist teachers diagnosed learning skills experiment with the use of multiple use of instructional approaches, assess pupil outcomes, assess staff development needs and teacher school personnel about effective pedagogical approaches. The center shall maong other functions facilitate the sharing of resources, ideas, methods, and approaches and provide inservice programs. The sum of $200,000 is appropriated for teacher centers over the biennium.

Program Improvement Grants

The State Board of Education with the advice of the State Curriculum Advisory Committee and the Advisory Committee on Technology shall make grants to groups of school districs to implement plans to improve education. To be eligible for a grant, a group of districts must:

1) create a consolidated district of at least 600 pupils;

2) establish an education district according to the criteria set out above;

3) enter into an greement for discontinuing grades when the districts entering into the agreement have a total of at least 240 pupils in grades 10, 11 and 12;

4) enter into a joint power ageement for technology cooperative.

The board shall determine the amount of each grant but no grant shall exceed $250,000 for a group of districts.

ARTICLE 8

TECHNOLOGY AND EDUCATIONAL IMPROVEMENT

SECTION 1. (121.60) (SUBJECT AREA INSERVICE TRAINING.)

Subdivision 1. (ESTABLISHMENT.) The department of education shall establish a program for providing inservice training to school district staff. During the first year, the program shall provide inservice training to elementary and secondary staff in mathematics, science and social science. For each succeeding year of the program, the commissioner shall recommend to the legislature subject areas for which inservice training programs shall be provided. Inservice training programs shall be designed to offer a broad spectrum of experiences, including activities which require active participant involvement rather than classroom lectures. To the extent possible, the inservice training programs shall be integrated with the technology inservice training provided according to sections 14 and 15 of this article.

Subdivision 2. (PROPOSALS.) Grant proposals submitted by eligible applicants to the department shall include at least the following:

a) a variety of staff education activities which are designed to assess and upgrade skills of those attending the training program;

b) provisions for addressing the requirements for licensure for those staff who currently are not licensed in the designated areas but who desire to be so licensed;

c) a plan for staff who participate in the training program to return to their school districts and provide training programs or disseminate information on inservice programs to other staff in their districts and regions;

d) a process for notifying staff in the state who teach in the designated subject areas and who are eligible for the program, a process for selecting staff to participate in the inservice training program, and a mechanism for evaluation to be provided to the state board upon completion of the program;

e) an estimated budget for the program, which shall provide for tuition expenses, related expenses including meals and lodging, and a stipend for participants in the program; and

f) other information that may be requested by the department.

Subdivision 3. (ELIGIBLE APPLICANTS.) The department may allocate money to public or nonpublic institutions of higher education, public or private nonprofit organizations, educational cooperative service units, or school districts for the purpose of providing inservice training according to this section. When approving or disapproving grants, the department shall ensure geographic accessibility of the programs to teachers throughout the state and a balance of programs available in different subject areas.

Subdivision 4. (CONSULTATION.) When making grants for the inservice training programs according to this section, the department shall consult with elementary and secondary staff in the designated subject areas to ensure that proposals submitted incorporate recent research findings and address the retraining needs of staff in those subject areas.

Subdivision 5. (PRIVATE MONEY.) The commissioner of education may accept contributions from additional private or public sources to supplement state money provided by this section. These contributions shall be added to the total amount of available state money and shall be administered by the department in the same manner as state money.

Subdivision 6. (FEDERAL MONEY.) The commissioner of education shall apply for and accept all federal money available for inservice training programs in the designated subject areas.

Subdivision 7. (APPLICATION DATES.) Applications for inservice training programs to be conducted during a school year shall be submitted to the department by January 15 preceding the beginning of that school year. The department shall approve or disapprove applications by the following March 1.

SECTION 2. (121.608) (INSTRUCTIONAL EFFECTIVENESS PLAN.)

By January 1, 1984, the commissioner of education shall develop a comprehensive statewide plan for maintaining and improving instructional effectiveness in the schools. The plan shall encourage implementation of school effectiveness strategies based on research findings in the area, develop inservice training models for school district staff, integrate developments in educational technology with classroom instruction models, and develop a mechanism for establishing a statewide network to coordinate and disseminate information on research in instructional effectiveness. The commissioner may employ consultants and specialists to assist in the development of the plan, and, to the extent possible, shall utilize the information provided by the planning, evaluation, and reporting process and the statewide assessment program.

SECTION 3. (121.609) (INSTRUCTIONAL EFFECTIVENESS TRAINING.)

Subdivision 1. (ADVISORY TASK FORCE; PROGRAM MODEL.) By January 1, 1984, the commissioner of education shall appoint an advisory task force to assist the department of education, in cooperation with the educational cooperative service units, in developing an implementation model for training school district staff in instructional effectiveness. The training program model shall be based on established principles of instructional design and the essential elements of effective instruction as determined by educational research. The training program model shall take into account the diverse needs of the school districts due to such factors as district size and location, and shall be structured to facilitate regional delivery of the training through the educational cooperative service units.

Subdivision 2. (PILOT TESTING OF TRAINING MODEL.) Between January 1, 1984, and January 1, 1985, the commissioner shall administer a pilot program of the instructional effectiveness training models which shall be implemented in at least 20 pilot sites throughout the state. The advisory task force established in subdivision 1 of this section may recommend modifications in the training models as necessary.

Subdivision 3. (EVALUATION AND REPORT.) The commissioner shall pay an independent evaluator to conduct an evaluation of the effectiveness of this section. The evaluator shall submit a report, including a sample survey of district personnel trained at the pilot sites, to the commissioner by January 1, 1985.

SECTION 4. (121.612) (CITATION.)

Subdivision 1. This section may be cited as the "Minnesota Academic Excellence Act."

Subdivision 1a. (CREATION OF FOUNDATION.) There is created the Minnesota Academic Excellence Foundation. The purpose of the foundation shall be to promote academic excellence in Minnesota public schools through a public-private partnership. The foundation shall be a nonprofit organization.

Subdivision 2. (BOARD OF DIRECTORS.) The board of directors of the foundation shall consist of the governor or the governor's designee; the chairpersons of the education committee and education finance division in the house of representatives and the chairpersons of the education committee and education subcommittee on education aids in the senate; a minority member of the house of representatives to be appointed by the house minority leader; a minority member of the senate, to be appointed by the senate minority leader; the commissioner of education; and 15 members to be appointed by the governor. Of the 14 members appointed by the governor, six shall represent various education groups and nine shall represent various business groups. The board of directors shall meet as soon as possible after the effective date of this section. The commissioner of education shall serve as secretary for the board of directors and provide administrative support to the foundation.

Subdivision 3. (FOUNDATION PROGRAMS.) The foundation shall plan for programs which advance the concept of educational excellence. These may include but are not limited to:

a) recognition programs and awards for students demonstrating academic excellence;

b) summer institute programs for students with special talents;

c) recognition programs for teachers, administrators, and others who contribute to academic excellence;

d) summer mentorship programs with business and industry for students with special career interests and high academic achievements;

e) governor's awards ceremonies to promote academic competition; and

f) consideration of the establishment of a Minnesota high school academic league.

To the extent possible, the foundations shall make these programs available to students in all parts of the state.

Subdivision 4. (PRIVATE FUNDING.) The foundation shall seek private resources to supplement the available public money. Individuals, businesses, and other organizations may contribute to the foundation in any manner specified by the board of directors. All money received shall be administered by the board of directors.

Subdivision 5. (REPORT.) By February 1, 1984, and February 1, 1985, the board of directors of the foundation shall report to the education committees of the legislature on the progress of its activities made pursuant to the provisions of this section.

SECTION 5. Minnesota Statutes 1983, section 122.41, is amended to read;
(122.41) (POLICY.)

~~It is hereby declared to be~~ The policy of the state is to encourage ~~the~~ organization of school districts into ~~such local~~ units of administration as ~~will~~ to afford better educational opportunities for all pupils, make possible a more economical and efficient operation of the schools, and insure a more equitable distribution of public school revenue. To this end all area of the state shall be included in an independent or special school district maintaining classified elementary and secondary schools, grades one through twelve, unless a district has made an agreement with another district or districts as provided in section 8 of this article or 122.541.

SECTION 6. Minnesota Statutes 1982, section 122.43, is amended to read;
(122.43) (DISSOLUTION OF DISTRICTS NOT A PART OF INDEPENDENT DISTRICTS.)

Subdivision 1. If there be Any organized school district not a part of an independent school district maintaining classified elementary and secondary schools, grades one through twelve is dissolved, unless the district has made an agreement with another district or districts as provided in section 8 of this article or 122.541, ~~such district shall hereby be dissolved~~.

Subdivision 2. The board of each district so dissolved shall continue to maintain school ~~therein~~ until all its territory ~~thereof~~ has been attached to a proper district not later than July 1, ~~but~~. Such boards shall ~~have power and authority~~ only ~~to~~ make such contracts and ~~to~~ do such things as are necessary to maintain schools properly ~~the schools~~ for the period they may be in session prior to the attached.

SECTION 7. Minnesota Statutes 1982, section 122.44, is amended to read;
(122.44) (PROCEDURE FOR ATTACHMENT TO ORGANIZED DISTRICTS; ~~PROCEDURE~~.)

Subdivision 1. Upon notice and hearing, as provided in section 122.22 for the attachment of dissolved districts, all territory of school districts dissolved by sections 122.41 to 122.52 and all area of the state not in a district maintaining classified elementary and secondary schools shall be attached by order of the county board to organized districts maintaining classified elementary and secondary schools, grades one through twelve, unless a district has made an agreement with another district or districts as provided in section 8 of this article or 122.541.

SECTION 8. (122.535) (AGREEMENTS FOR SECONDARY EDUCATION.)

Subdivision 1. (APPLICABILITY.) The provisions of this section shall apply to a district with fewer than 375 pupils enrolled in grades 7 through 12.

Subdivision 2. (AGREEMENT.) The school board may enter into one or more agreements providing for instruction of its secondary pupils in one or more districts. The agreement shall be effective on July 1 and shall be for a specified or indefinite number of years. The agreement shall set forth the obligations of transportation, the tuition to be paid to the providing district, and all additional charges and fees to be paid to the providing district. The amount of tuition shall not be subject to the provisions of section 124.18, subdivision 2. The agreement may provide for negotiation of a plan for the assignment or employment in a providing district as an exchange teacher according to section 125.13, or placement on unrequested leave of absence of teachers whose positions are discontinued as a result of the agreement. "Teacher" has the meaning given it in section 125.12, subdivision 1.

Subdivision 3. (INFORMATIONAL MEETING.) Before entering into agreements permitted by subdivision 2 of this section, the school board shall hold a public hearing. The board shall publish notice of the hearing in the newspaper with the largest circulation in the district. If the board proposes to enter into agreements with two or more districts, the board may conduct separate or consolidated hearings.

Subdivision 4. (REVIEW AND COMMENT.) After the hearing required by subdivision 3.of this section and before entering into an agreement, the board shall submit the agreement to the commissioner of education for review and comment.

Subdivision 5. (AID PAYMENTS.) A district entering into an agreement permitted in subdivision 2 of this section shall continue to count its resident pupils who are educated in other districts as resident pupils in the calculation of pupil units for the purposes of state aids, levy limitations, and any other purpose. A district may continue to provide transportation and collect transportation aid for its resident pupils. For purposes of aid calculations, the commissioner of education may adjust the cost per eligible pupil transported to reflect changes in cost resulting from the agreement, if any.

SECTION 9. Minnesota Statutes 1982, section 123.741, subdivision 1, is amended to read;

Subdivision 1. The school board of each school district in the state shall develop and adopt a written educational policy which establishes educational goals for the district, a process for achieving these goals, and procedures for evaluating and reporting progress toward the goals. These goals shall include meeting the curriculum requirements adopted by the state board of education. The school board shall review this policy each year and adopt revisions which it deems desirable. School boards are encouraged to develop this school district policy and any revisions after consultation with the staff of each school building. In formulating the policy, the school board of a district is encouraged to consider; a) the number of dropouts of school age in the district and the reasons for the dropouts; b) existing programs within the district for dropouts and potential dropouts and c) program needs of dropouts and potential dropouts.

SECTION 10. (129B.10) (CITATION.)

Sections 12 to 20 of this article may be cited as the "Minnesota Education Technology Act."

SECTION 11. (ADVISORY COMMITTEE ON TECHNOLOGY IN EDUCATION.)

By July 1, 1983, a 15 member advisory committee on technology in education shall be appointed by the governor to assist in the implementation of sections 13 to 20 of this article. Representation on the advisory committee shall include public school teachers and administrators, school boards, parents, department of education, Minnesota educational computing consortium, at least one regional management information center, council on quality education, higher education, and at least two members from high technology business and industry. Advisory committee members shall be knowledgeable about the use of technology in elementary and secondary education. The advisory committee shall terminate on June 30, 1985.

SECTION 12. (129B.11) (DEFINITIONS.)

Subdivision 1. (APPLICABILITY.) For the purpose of sections 13 to 20 of this article, the following terms have the meanings given them, unless clearly provided otherwise.

Subdivision 2. (AVERAGE DAILY MEMBERSHIP.) "Average daily membership" has the meaning given it in section 124.17, subdivision 2.

Subdivision 3. (COURSEWARE PACKAGE.) "Courseware package" means integrated videotape and videodisk, computer disk, and software and its supporting materials, such as workbooks and textbooks.

Subdivision 4. (STATE BOARD.) "State board" means state board of education.

Subdivision 5. (ADVISORY COMMITTEE.) "Advisory committee" means the advisory committee on technology in education established in section 11 of this article.

Subdivision 6. (TECHNOLOGY.) "Technology" includes, but is not limited to, computers, telecommunications, cable television, interactive video, film, low-power television, satellite communications, and microwave communications.

SECTION 13. (129B.12) (TECHNOLOGY UTILIZATION PLANS.)

Subdivision 1. (DEVELOPMENT OF PLAN.) Each school district is encouraged to develop and adopt as part of its educational policy a written technology utilization plan, in consultation with the curriculum advisory committee for planning, evaluation, and reporting appointed pursuant to section 123.741, subdivision 3. The district is encouraged to review the plan each year and adopt revisions as desired.

Subdivision 2. (ELIGIBILITY FOR AID.) Each school district which intends to prepare and submit a technology utilization plan that complies with this section is eligible to receive state aid. Application forms shall be provided to districts by the department of education by August 31, 1983.

Subdivision 3. (AID FOR PLANNING.) A school district which applies for aid to develop a technology utilization plan shall receive $0.75 times average daily membership for the 1982-1983 school year. No district which applied for aid shall receive less than $500.

Subdivision 4. (PAYMENT FOR AID; SUBMISSION OF PLANS.) The department of education shall pay aid to a district within 30 days of receiving the district's application. Districts which receive aid shall submit technology utilization plans by January 31, 1984, or within 90 days of receiving aid, whichever is later.

Subdivision 5. (CONTENTS OF PLAN.) The plan shall describe:

a) how technology will be used to provide educational opportunities for people of all ages residing in the district, affirmatively addressing the needs of special populations, including females, minorities, and the disabled;

b) goals for implementing the use of technology in the districts, including instruction and management uses;

c) means to achieve these goals, including proposed teacher inservice training;

d) procedures for integrating the use of technology into the district's community education program; and

e) procedures to evaluate and report progress toward the goals.

Subdivision 6. (MODEL PLANS.) By August 31, 1983, the department of education, in consultation with the advisory committee, educational cooperative service units, Minnesota educational computing consortium, and appropriate regional management information centers formed according to section 121.935, subdivision 1, shall develop model plans and criteria for evaluating district plans. The department may employ consultants and specialists to assist in this effort. The model plans and criteria shall be distributed to districts, and the department shall assist in developing district plans, upon request.

Subdivision 7. (APPROVAL OF PLAN.) The state board shall approve or disapprove a plan within 60 days of receiving the plan submitted by a district. The plan may be modified by the district, in consultation with the department, at any time prior to state board action on the plan. A plan that is disapproved may be revised and resubmitted for approval.

SECTION 14. (129B.16) (INSERVICE TRAINING FOR USE OF TECHNOLOGY.)

Subdivision 1. (ELIGIBILITY FOR AID.) Each school district with an approved technology utilization plan, according to section 13 of this article, may apply for state aid to provide inservice training for elementary and secondary public school staff on the use of technology in education. The inservice training should not be limited to formal classroom presentations. School districts are encouraged to cooperate in providing inservice training for staff members.

Subdivision 2. (APPLICATIONS.) Applications containing specific inservice training proposals for a district or combination of districts shall be submitted by December 1, 1984, in the form and manner prescribed by the department of education. The department shall approve or disapprove applications within 60 days of receipt.

Subdivision 3. (AMOUNT OF AID.) A district or combination of districts whose application is approved shall receive $1 times average daily membership for the 1982-1983 school year. Aid shall be paid within 30 days of approval.

Subdivision 4. (STATEWIDE INSERVICE TRAINING.) By June 30, 1985, the department shall provide for supplemental regional or statewide inservice training for district staff on the use of technology in education. The department may employ consultants or specialists for this purpose, but shall ensure that these training activities do not duplicate or conflict with services provided by other governmental agencies or organizations.

SECTION 15. (129B.18) (REGIONAL COORDINATORS.)

The Minnesota educational computing consortium shall provide regional instructional computing coordinators with expertise in the use of technology in education. The Minnesota educational computing consortium and the department of education shall agree on the services to be provided by the regional coordinators. Among other responsibilities, the regional coordinators shall serve as onsite consultants to districts participating in technology utilization planning and inservice training.

SECTION 16. (129B.20) (TECHNOLOGY DEMONSTRATION SITES.)

Subdivision 1. (SITE DESIGNATION.) By January 15, 1984, the state board shall designate from eight to ten districts as technology demonstration sites and award each district a grant for use during the 1983-1984 and 1984-1985 school years.

Subdivision 2. (CRITERIA FOR SELECTION.) In consultation with the department of education, appropriate regional management information centers, and the Minnesota educational computing consortium, the advisory committee shall develop selection criteria for review by the state board. The state board shall establish selection criteria to be distributed to districts by October 1, 1983. Criteria shall include at least the following:

a) exemplary program of technology utilization existing in the district;

b) evidence of willingness by district staff and the community to incorporate technology fully into the curriculum to demonstrate new instructional methods;

c) willingness to match the grant awarded to the district; and

d) willingness to share educational experiences with other intersted parties.

For two of the sites, criteria may include participation of Minnesota high technology business or industry. Clause (a) may be excluded as a factor in selection of the two sites, one of which may be a rural district.

Subdivision 3. (SITES THROUGHOUT THE STATE.) To the extent possible, the selected sites shall be geographically well-distributed with representation from urban, suburban, and rural areas.

Subdivision 4. (GRANT AWARDS.) Applications for grants shall be submitted to the state board by December 1, 1983, in the form and manner prescribed by the department. Grants shall be awarded by January 15, 1984.

Subdivision 5. (RECIPIENT DUTIES AND USE OF MONEY.) A district selected for a grant shall work cooperatively with the advisory committee, department of education, Minnesota educational computing consortium, higher education institutions in the area, and business and industry, as appropriate. A district selected for a grant shall have a technology utilization plan according to section 13 of this article. The district shall conduct at least one workshop each school year of the grant to demonstrate to other districts and interested parties its use of technology in education. Grant money may be used for equipment, consultants, curriculum development, and teacher training.

Subdivision 6. (PRIVATE FUNDING.) The advisory committee shall seek funding aid and in-kind contributions from private sources to supplement state money for the purpose of awarding grants. Private contributions may be made directly to the technology demonstration sites.

Subdivision 7. (EVALUATION OF SITES.) The state board shall evaluate the technology demonstration sites. It may contract with independent evaluators for this purpose.

SECTION 17. (129B.22) (COURSEWARE PACKAGE EVALUATION.)

Subdivision 1. (LIST.) By January 1, 1984, the department of education shall compile, publish, and distribute to districts a list of high quality courseware packages for use in public elementary and secondary schools. Every six months thereafter, the department shall supplement the list with recently evaluated materials.

Subdivision 2. (PROCUREMENT.) The department shall obtain courseware packages for evaluation by notifying publishers and inviting them to submit their materials. The department may provide for evaluation of courseware packages that have not been submitted, if districts express strong interest in using the courseware packages.

Subdivision 3. (CRITERIA.) The state board shall develop and adopt criteria and procedures for evaluation of courseware packages, in consultation with the department, advisory committee, appropriate regional management information centers, and the Minnesota educational computing consortium. The procedures developed shall contain a provision for resubmission of a courseware package. Chapter 14 shall not apply to the criteria and procedures.

Subdivision 4. (CONSULTANTS.) The department may employ consultants to evaluate courseware packages and pay them fees based on the size and complexity of the courseware package involved. The evaluators shall certify to the state board that they have no financial interest in the product being evaluated or any similar or competing product.

Subdivision 5. (EVALUATION TEAM.) The evaluation team for each courseware package shall include at least five persons, including three practicing teachers, from appropriate grade level or content areas, who will field test the courseware packages in their classrooms; one microcomputer professional knowledgeable in software and documentation techniques; and one curriculum content expert from the department. Each evaluation team member shall use the criteria and procedures adopted by the state board and submit a written report to the department upon completion.

Subdivision 6. (HIGH QUALITY.) Based on the reports submitted by evaluation team members and the criteria and procedures adopted by the state board, the department shall determine whether the courseware package qualifies as high quality. The results shall be recorded in a standardized format and be available at the department for review by the courseware package producer and other interested persons.

Subdivision 7. (DISPOSITION.) The department shall maintain a collection of the courseware packages evaluated as high quality. These materials shall be available to the public for review.

SECTION 18. (129B.23) (SUBSIDY FOR PURCHASE OF COURSEWARE PACKAGES.)

Subdivision 1. (AID AMOUNT.) A district that purchases or leases courseware packages that qualify as high quality according to section 17 of this article shall receive state aid. The aid shall be equal to the lesser of:

a) $1.60 times average daily membership for the 1982-1983 school year; or

b) 25 percent of the actual expenditures of the district for purchase or lease of the courseware packages between January 1, 1984, and May 31, 1985.

Subdivision 2. (AID PAYMENT.) Applications for aid shall be submitted in the form and manner prescribed by the department. Payment of aid shall be made by July 31, 1984, for applications received by June 30, 1984. Payment of aid shall be made by June 30, 1985, for applications received between July 1, 1984, and May 31, 1985.

SECTION 19. (129B.24) (PURCHASE OF COURSEWARE PACKAGE DUPLICATION RIGHTS.)

Rights to duplication of courseware packages may be purchased, and volume purchase agreements may be established by the department of education, if the department determines that the courseware packages qualify as high quality according to section 17 of this article, and if the courseware packages are available to the state at a lower cost than if purchased by school districts individually. The department shall make the courseware packages available to the Minnesota educational computing consortium for distribution to districts. The materials shall be available to districts without cost except for nominal costs of reproduction and distribution.

SECTION 20. (129B.26) (COURSEWARE PACKAGE DEVELOPMENT.)

Subdivision 1. (NEW COURSEWARE PACKAGES.) The Minnesota educational computing consortium, in consultation with the department of education, is authorized to develop and design courseware packages which will meet the needs of school districts and which otherwise are unavailable or too expensive for individual districts or the state to purchase. The Minnesota educational computing consortium may:

a) contract with school districts, private entrepreneurs, and other public or private agencies for the development of a specified courseware package;

b) assist entrepreneurs to develop their own ideas for courseware packages that could be used in school districts, by providing funds for that purpose;

c) secure copyrights for those materials in which it has a whole or part interest;

d) sell developed courseware packages at cost to school districts in Minnesota and at commercial rates elsewhere; and

e) sell or contract for the marketing of courseware packages.

The department of education shall evaluate whether the courseware packages qualify as high quality according to the criteria and procedures established in section 17 of this article.

Courseware packages developed according to this subdivision shall become the property of the Minnesota educational computing consortium. Revenue from the sale of these courseware packages shall be used to develop additional courseware packages according to this section.

Subdivision 2. (DISTRIBUTION.) The Minnesota educational computing consortium may sell courseware packages to Minnesota school districts at cost and may sell to school districts in other states and to the general public at commercial rates. Each contract with a developer who shares in the profits of distribution shall include a provision requiring sale of the courseware packages at cost to Minnesota school districts.

SECTION 21. (INCREASE IN COMPLEMENT.)

To implement the provisions of sections 13 to 20 of this article, the department of education may increase its complement by two positions: one education specialist II and one clerical support position. The positions are in the classified service of the state civil service.

SECTION 22. (REPORT ON NEED FOR CURRICULUM CHANGES.)

By October 1, 1983, the commissioner of education shall develop and submit a report to the education committees of the legislature on the need for amending current rules governing curriculum requirements in the elementary and secondary public schools. In developing the recommendations, the commissioner shall consider the extent to which the proposed curriculum requirements shall adequately prepare the students for entering post-secondary institutions. The report shall include at least the following:

1) preliminary information on the extent to which school districts are in compliance with the current curriculum requirements established in state board rules;
2) a preliminary draft of proposed rules which would increase the curriculum requirements in elementary and secondary schools;
3) recommendations for changes in the laws which impose penalties for noncompliance with state board of education rules;
4) development of a statewide monitoring system to ensure compliance with curriculum requirements;
5) assessment of the feasibility of establishing learning requirements for elementary and secondary students to complete outside the classroom; and
6) recommendations for changes in high school graduation requirements and achievement standards.

SECTION 23. (RULEMAKING ON CURRICULUM.)

By September 1, 1984, the state board of education shall adopt rules pursuant to chapter 14, establishing elementary and secondary curriculum requirements which will ensure that a minimum comprehensive educational program is available to all public school students in the state. The rules adopted by the state board shall be effective beginning in the 1985-1986 school year.

SECTION 24. (REPORT TO LEGISLATURE.)

The department of education shall evaluate the concept of extending the school year. The department shall consider at least the following: educational benefits, methods to extend the school year, fiscal implications, and other relevant factors. By November 1, 1983, the department shall report its findings and recommendations to the education committees of the legislature.

SECTION 25. (REPORTS TO THE LEGISLATURE.)

By February 1, 1984, the department of education shall report to the education committees of the legislature on the progress of implementing the programs in sections 1 to 3, and 13 to 20 of this article.

By February 1, 1985, the department of education shall report to the education committees of the legislature on preliminary evaluations of the programs and participants in sections 1 to 3, and 13 to 20 of this article.

SECTION 26. (APPROPRIATIONS; DEPARTMENT OF EDUCATION.)

Subdivision 1. There is appropriated from this general fund to the department of education the sums indicated in this section. The sums are available until June 30, 1985.

Subdivision 2. (SUBJECT AREA INSERVICE TRAINING.) The sum of $500,000 is appropriated for the purpose of section 1 of this article. The department may use up to $50,000 of this appropriation for administration and evaluation of the program.

Subdivision 3. (INSTRUCTIONAL EFFECTIVENESS PLAN.) The sum of $50,000 is appropriated for the purposes of section 2 of this article.

Subdivision 4. (INSTRUCTIONAL EFFECTIVENESS TRAINING.) The sum of $300,000 is appropriated for the purposes of section 3 of this article. No more than $15,000 shall be used for the evaluation required in section 3, subdivision 3 of this article.

Subdivision 5. (ACADEMIC EXCELLENCE FOUNDATION.) The sum of $150,000 is appropriated for the purpose of section 4 of this article. No more than $50,000 of this amount shall be used for administrative costs. The foundation shall add to this appropriation any additional money raised from other sources.

Subdivision 6. (TECHNOLOGY UTILIZATION PLANS.) The sum of $650,000 is appropriated for the purposes of section 13 of this article.

The department may use up to $63,000 of the appropriations for costs of developing model plans and criteria, assisting districts to develop plans, and evaluating the program.

Subdivision 7. (INSERVICE TRAINING.) The sum of $936,000 is appropriated for the purposes of section 14 of this article.

The department may use up to $220,000 of the appropriation for supplemental regional or statewide inservice training.

Subdivision 8. (TECHNOLOGY DEMONSTRATION SITES.) The sum of $1,600,000 is appropriated for the purposes of section 16 of this article. The department may use up to $15,000 of the appropriations for costs of administering the program and up to $40,000 for evaluating the program. The department shall allocate $300,000 for the costs of inservice training conducted at the demonstration sites, including partial substitute pay and travel expenses for visitation to the sites from districts within the state.

Subdivision 9. (COURSEWARE PACKAGE EVALUATION.) The sum of $200,000 is appropriated for the purposes of section 17 of this article. The department may use up to $15,000 of the appropriation for costs of administering the program.

Subdivision 10. (SUBSIDY FOR COURSEWARE PURCHASE.) The sum of $1,154,000 is appropriated for the purposes of section 18 of this article.

Subdivision 11. (PURCHASE OF COURSEWARE DUPLICATION RIGHTS.) The sum of $225,000 is appropriated for the purposes of section 19 of this article.

Subdivision 12. (INCREASE IN COMPLEMENT.) The sum of $125,000 is appropriated for the purposes of section 21 of this article.

SECTION 27. (APPROPRIATIONS; MINNESOTA EDUCATIONAL COMPUTING CONSORTIUM.)

Subdivision 1. There is appropriated from the general fund to the Minnesota educational computing consortium the amounts indicated in this section for the fiscal years ending June 30 in the year designated. Any unexpended balance from the appropriation for fiscal year 1984 shall not cancel but shall be available for fiscal year 1985.

Subdivision 2. (REGIONAL COORDINATORS.) For regional instructional computing coordinators as provided in section 15 of this article, there is appropriated:

$280,000.....1984,
$280,000.....1985.

Subdivision 3. (COURSEWARE PACKAGE DEVELOPMENT.) The sum of $250,000 is appropriated for fiscal year 1984 for the purposes of section 20 of this article. The Minnesota educational computing consortium shall supplement this appropriation from other sources in its budget for the purpose of developing courseware packages.

SECTION 28. (EFFECTIVE DATE.)

INFORMATION TECHNOLOGY

LEARNER OUTCOMES

An Overview

CURRICULUM AND TECHNOLOGY SECTION

MINNESOTA DEPARTMENT OF EDUCATION

INFORMATION TECHNOLOGY PHILOSOPHY

A highly technical world requires a changed education. In a challenging global information society, we need a different kind of education than we have had before:

An education that emphasizes creativity, higher-order skills, problem-solving, conceptual mastery, intellectual independence, the ability to express oneself clearly, and to work collaboratively with others, including people with different political, social and economic values;

An education that encourages schools to be microcosms of the "real world," thus enabling students to experience the ambiguities of life in a protected environment;

An education where students are given opportunities to use information technology to address and fulfill personal and societal educational needs, encouraging individual potential to unfold.

Information Technology certainly will play a major role in educational efforts of the future. However, the philosophical direction we give Information Technology today will help determine how well the new educational needs of the future are addressed. This document has several assumptions/value premises that need to be identified. One initial assumption is that what is written in this document represents our best thinking today, but that any plan developed must be viewed as dynamic and subject to systematic review and modification. There is no doubt that technologies and the accompanying learning materials will improve. Educators must be willing and able to accommodate additional technological opportunities that enhance education in meaningful and positive ways.

A second major assumption is that educational technologies need to be considered as one of several instructional tools and delivery systems available for learning and teaching--superior in some situations and inferior in others. The criteria for evaluating these tools should consider, primarily, how well they help enhance the quality of learning and how appropriately they prepare students for functioning in tomorrow's society.

Technology does offer great potential, however, certain educational considerations must be examined and addressed in an appropriate manner if the necessary synthesis is to occur. A very important assumption is recognition that technological objectives should be integrated into the entire curriculum to help students see their effects in all facets of life. Technology should be the means by which students gain broader options in learning activities and, in the process, learn how to use technology. Technology should be a tool or means to educate--not the end product.

A fourth assumption is that great effort will be made to ensure that technology tools, software and instruction on major applications such as word processing, electronic spreadsheets and databases are made available to all socioeconomic levels in rural, suburban and urban communities. Similar special attention must be given to ensuring the involvement of women, minorities and the handicapped. While not everyone will work in a high-technology job, every person will have his or her life and occupation severely affected by technology. The inability to understand and use technology will be a handicap to fulfillment of many personal goals.

Another assumption that will be highlighted in this document is the belief that considerable effort must be made to ensure that students learn and use higher-level thinking applications of technology. We believe the potential of technology cannot be fulfilled unless students are taught problem-solving and decision-making skills that have real-life implications and uses.

Changes once occurred very slowly. Now, not only are the changes occurring at a rapid rate, but the rate of change is accelerating to the point that information is doubling every eight years in most areas, and in some areas, such as microbiology and computer engineering, every 18 months. Technology in society is not a fad. Experts estimated that over $59 billion were spent on telecommunication resources in 1983 and that $88 billion will be spent in 1988. Resources devoted to the purchase and operation of computer-related expenses were estimated to be $150 billion in 1983, an amount that is expected to increase to as much as $700 billion in 1993. Total expenditures in high-technology areas were estimated at $400 billion in 1983. There is disagreement about how high future totals might be, since new applications of technology are being developed daily. Given those figures, it is obvious that businesses are recognizing and responding to demand for rapid changes in the amount and uses of technology.

Rapid changes require institutions to take risks and make significant changes. Minnesota's educational institutions must take risks and make changes if students are to compete successfully in an economic and social structure with global implications. The emerging society requires the processing of vast amounts of information to solve problems and make quality decisions. There is an increasing need to know more, to know how to access vast amounts of information and to improve the way and the rate at which we learn. Technology offers educators a means to address those increasing demands on education. If educators accept the changes as a challenge rather than a crisis, and seize the opportunities provided, they can make education more exciting and productive than ever before.

APPENDIX H

Brief Summary of Minnesota Technology Demonstration Sites

From: Minnesota Department of Education, Minnesota Technology Demonstration Sites, January, 1986.

Minnesota Technology Demonstration Sites, p. 1

Site	Emphasis	Contact
Austin-Rochester	Two way Television Full-powered public broadcast television studio. (Austin) Cablecast from one building to another throughout the district.(Rochester)	Mahlon Wissink Rochester Public Schools 615 SW 7th St. Rochester, MN 55902 507-285-8732
Bloomington	Computer labs Satellite receiving equipment TV production with interactive teaching via closed circuit and cablecast	Wallace Kennedy or John Parker Bloomington Public Schools 8900 Portland Ave. S. Bloomington, MN 55420 612-887-9152
Blue Earth	Computer saturation (One computer per student)	Gary J. Honkin Blue Earth Public Schools 6th and Galbraith Blue Earth, MN 56013 507-526-3215
East Central Minnesota Educational Cable Cooperative	Interactive TV TV studio Satellite receiving dish	Brad Windschill Westview High School Braham, MN 55006 612-396-3674
Hopkins	Computerized instructional management system Use computer software to address thinking skills Inservice Computerized library	Dr. Donald Sension Hopkins Public Schools 1001 Highway 7 Hopkins, MN 55343 612-933-9230
Innovative Inservice for Integrating Technology in Classrooms (IN-TECH)	Inservice training for teachers	Randy Johnson Anoka-Hennepin Public Schools 11299 Hanson Blvd. NW Coo Rapids, MN 55433 612-755-8220

Minnesota Technology Demonstration Sites, p. 2

Site	Emphasis	Contact
Knowledge Interactive Distribution System (KIDS)	Two-way interactive television and audio Teleconferencing	Dr. Frank R. Birmingham St. Peter High school Lincoln Drive, Room 120 St. Peter, MN 56082 507-931-4210
Mid-States Educational Telecommunications Cooperative	Two way interactive television	Jerry Abraham Little Falls High School 1001 SE 5th Ave. Little Falls, MN 56345 612-632-2921
Minneapolis	Integrating computers into the science curriculum Using satellites in curriculum Satellite receiving site	Cort Smith North Community High school 1500 James Avenue North Minneapolis, MN 55411 612-627-2782
Minnesota Valley Tele-Network	Two way television curriculum	Lynn Steenblock Montevideo High School 13th Street and Williams Ave. Montevideo, MN 56265 612-269-9297
Northeast Educational Technology Consortium	Computer assisted drawing PLATO	Don Garnett Duluth Public Schools Lake Avenue and 2nd Street Duluth, MN 55802 218-743-4102
St. Louis Park/ Tower-Soudan	Cooperative learning using technology Senior high based LOGO	Deborah Meininger St. Louis Park Public Schools 6425 West 33rd Street St. Louis Park, MN 55426 612-925-4300
Shakopee	Local area Networking Hard drive networks	Ron Ward Shakopee Junior High School Shakopee, MN 55379 612-445-4884

Minnesota Technology Demonstration Sites, p. 3

Site	Emphasis	Contact
Sherburne-Wright Educational Technology Cooperative	Two way interactive television Satellite downlinks	Will Kitchen Monticello Public Schools Box 897 Monticello, MN 55362 612-295-5184
Sibley County Cooperative	Interactive cable TV	David Czech Sibley County Vocational Center Box 868 Arlington, MN 55307 612-964-5105
Southwest Minnesota Telecommunications Project	Interactive TV (microwave)	John Lowe Chandler-Lake Wilson Schools Box 98 Chandler, MN 56122 507-677-2387
Subject Matter Awareness - Implementation of Resources in Technology (SMART)	Train teachers to make optimum use of technological materials and equipment currently available	Alice Hofstad Northwest ECSU Box 390 Thief River Falls, MN 56701 218-681-8005
Technology Learning Campus	Integrating district technology learner outcomes into those of the state Integrating software into curriculum	Barbara Nemer Technology Learning Campus 4139 Regent Avenue North Robbinsdale, MN 55422 612-535-1790
Use of Integrated Computer System for Instruction in Reading and Math	PLATO/WICAT system in K-6	Henry Snyder Bel Air Elementary School 1800 5th Street NW New Brighton, MN 55112 612-633-3521
Woodland Cooperative Center Communicasting	Two way interactive TV (UHF and ITFS microwave)	James A. Hofer Woodland Cooperative Center NE 5th Street Staples, MN 56479 218-894-2438

APPENDIX I

List of Interviewees By Site

Albuquerque Public Schools

University of New Mexico
Alex Sanchez, Vice President Community and International Programs
Dave Colton, Dean, College of Education
Priscilla Norton, Faculty
Jack D. Gittinger, Jr., Faculty
Tony Oliver, Director of Credit Programs, Continuing Education

Albuquerque Public Schools:
Lillian C. Barna, Superintendent
Mary K. Nebgen, Deputy Superintendent, Instructional Services
Benjamin Soria, Assoc. Supt., Business and Operations
Barbara Blackwell, Asst. Supt. for Instructional Services/Curriculum Development
Richard Romero, Asst. Supt. for High Schools
Orlando Esparza, Asst. Supt. for Middle Schools
Bob Montoya, Asst. Supt. for Elementary Schools Elem.
John Modragon, Asst. Supt. for Elementary Schools
Charles Serns, Core Subjects Supervisor
Richard Ennes, Director of Supply Services
Bobby Richardson, Occupational Education Office
Al Sanchez
Jennifer Johns, Program Evaluation Specialist
Paul Resta, Special Assistant for Educational Computing
Paul Rost,Director, Chapter 1
Ron Williams, Director of Special Education
Russell Doff, Principal

Len Scrogan, Computer Education Coordinator
Betsy Janssen, Computer Resource Teacher
Patsy Carmichael, CERT Team
The CERT Team Staff

Don Whatley, President Albuquerque Teachers Federation
Helen Williams, Albuquerque Teachers Federation

Teachers:
Rheta Greenwood
Jackie Rider
Patti Devereax
Gracie Sellers
Joyce Silver
Patti Moscone
Kathleen Yarborough, Teacher/Trainer

Students:
Janie Kiffer, Ivan Bagley, Robt Pickes, Mark Vicuna, Davit Heit, Cindy Hernandez, Debbie Lujan, Doug Lujan

Technical - Vocational Institute:
Tony Galaz, Director of Evening Program

Apple Classroom of Tomorrow

Dr. Martin Engel, Project Manager, ACOT
Dr. David C. Dwyer, Education Research Manager, ACOT

ACOT teachers:
Faye Wilmore, Hermitage, Tennessee (near Nashville)
Nancy Morris, Memphis, Tennessee
Barbara Bayha, Cupertino, California

Cupertino Unified School District

Yvette Del Prado, Superintendent
Ron Lamar, Coordinator of Inservice
Barbara Bayha, ACOT Teacher
Harvey Barnett, Principal, Stevens Creek School

Workshop teachers interviewed:
Marilee Shelly, John Muir, Marcia McCafferty

Elementary School Consortium

John Armenia, Penninsula School District, Gig Harbor, WA
Tim Tarleton, Littleton School District, Littleton, CO
Judy Winfrey, Chinn Elementary School, Kansas City, MO
Sue Francis, Hamilton Park Elementary School, Richardson, Texas
Fairlie Bagley, Lawton Elementary School, Oviedo, FL
Nancy Warren, Seminole County Schools, Oviedo, FL
Dallas Rust, Ames Community Schools, Ames, IA
Dennis Daggett, Kenai Penninsula School District, Kenai, AK

Hennigan School

MIT Project Staff:
Seymour Papert
Sylvia Weie
Edith Ackerman
Stephen Ocko
Harry Nelson

MIT GraduateStudents:
Mitchell Resnick
Idet Harrell

Hennigan:
Bob Holland, Assistant Principal
The Project Headlight Teachers

Houston Independent School District

Kaye Killough, Deputy Superintendent
Carol Kuykendall, Assistant Superintendent for Curriculum
Patricia Sturdivant, Director, Department of Technology
Richard A. Smith, Manager, Instructional Development Team
Ellen Murphy, Instructional Development Team
Herman Blalock, Manager, Technical Training
Patsy Rogers, Manager, Procurement and Planning
Sandy Nix, Manager, School Services
Linda Caruso, Manager, Administrative Support
Anna DuTerroil, Manager, Special Projects
Mike Walters, Manager, Technical Support
Dan Daniel, Project Director
Lee Mercado, Project Director
Joan Grumet
Harold Byrd, Manager, Systems Design and Development,
Luke Lyons, Manager, Implementation Support

Principals' Advisory Committee who were interviewed:
Virgil Fisher, Jackson Middle School
Jim Prewett, CLifton Middle School
Jim Brock, Fondren Elementary School

Teacher Technologists Participants in Roundtable Discussion:
Janet Aligo, Poe Elementary School
Max Bisor, Bowie Elementary School
Nancy Chatman, Hartsfield School
Sherry Irby, Contemporary Learning Center
John Montroy, Sharpstown Middle School

IBM - National Computer Training Institute

Bruce Frederickson (Founder and President, NCTI)
William "Sandy" Wagner (Formerly with NCTI. Founder of California Computer Using Educators Group. Currently with IBM.)
Chuck Forsythe (NCTI Participant)
Holly Jobe (NCTI Participant)
Cos Civale (NCTI Participant and Sysop for NCTI on-line network, now EDEXCHANGE on the Source.)
Barbara Frietas, (NCTI Participant and now IBM Educational Instructional Specialist).

APPENDIX I: LIST OF INTERVIEWEES BY SITE

Jefferson County, Alabama, School District

Mrs. Henriette W. Gwin, School Board Member
Dr. Ronald Jones, Director of Staff Dvelopment
Nez Calhoun, Director of Public Relations
Gloria Soloman, Principal, Hewitt Elementary School
Rick Lasenby, Principal, Cahaba Heights Elementary School
Ozilene Cartee, Principal, Vestavia West Elementary School

Teachers:
Mara Jambor
Lynn Hudgins
Renee Houston
Lydia Edmonds
Sonja Carrington
Janie Beale
Chiquita Marbury
Alice-Marie Morrison
Selesta Meuse
CarolineStarnes

Group interviews with staff from: Hewitt Elementary School, Hewitt Middle, Grantswood, Leeds Elementary, Hillview Green Valley, Shades Mountain, Gardendale Elementary, Cahaba Heights Community, Vestavia West

Fred D'Ignazio, Project Director

Students:
Eric Jambor and Paul Ferguson, technical assistants to program and senior high students

Business:
Kenneth M. Penuel, Project Manager, Alabama Power Company
Julia Ann Partridge, Director of Public Information, Alabama Power Company

Follow-up interviews:
Janie Beale, Teacher
Chiquita Marbury, Teacher
Dr. Ronald Jones, Director of Staff Devlopment
Nez Calhoun, Director of Public Information
Fred D'Ignazio
Connie Gonser, Director of Curriculum, School District of Royal Oak, Michigan

APPENDIX I: LIST OF INTERVIEWEES BY SITE

Lesley College

Nancy Roberts, Director, Computers in Education
Susan Friel, Assoc Prof, Math/Computer Science

Faculty:
George E. Blakeslee
Rebecca Corwin
Ricky Carter
Karen Gremley
Ricky Carter
Karen Gremley
Len Scrogins (Field)
Tim Greenshields (Field)

Professional Outreach Associates
Frank Cordell
Louise Cordell

MINNESOTA

University of Minnesota, College of Education:
Dr. William Gardner, Dean
Dr. Alan Glen, Associate Dean
Dr. Carol Carrier, Assistant Dean
Greg Sales,Faculty

MECC:
Richard Pollack, Senior Researcher, MECC
Don Rawitsch, MECC Administrator

TIES:
Marla Davenport, Metro Region Technology Coordinator
Sheldon Ramnarine, Metro Region Technology Coordinator
State Department of Education, Curriculum and Technology Section:
Gilbert Valdez, Manager
Harold MacDermott

Minneapolis Public Schools:
Gladys Sheehan, Director, Media Services
Sally Sloan, Resource Teacher, Instructional Computers

Blue Earth Public School:
Gary Honken, Principal and ACOT Project Director
Suzan Sollie, District Computer Coordinator and ACOT Director
Layne Hopkins, Teacher and workshop instructor
Earl Gildemeister, workshop instructor
Marlin Gerdtz, Coordinator of Project Beacon
John Huisman, Secondary Principal
Sara Duden, Teacher
Summer Workshop Teachers:
Jean Fiskey, Teacher, Armstrong School, St. James School Dist, MN
Joe Adams, Teacher, Glenville, MN
Mitch Thompson, Teacher, Rushford, MN
AL Hastings, Computer Coordinator, Charles City, IO

Shakopee Junior High:
Ron Ward, Assistant Principal and Director Demonstration Project

St. Louis Park Public Schools:
Erik Adolphson, Instructional Computing